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South East Asia Design/Development Research

International Conference (SEA-DR 2016)

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GRADUATE PROGRAMME OF MATHEMATICS EDUCATION
MATHEMATICS AND NATURAL SCIENCES FACULTY
UNIVERSITAS NEGERI PADANG
APRIL, 17th-18th 2016

Message *from the* Rector of Universitas Negeri Padang

Ladies and Gentlemen,

It gives me great happiness to extend my sincere and warm welcome to the all participants of the Forth South East Asian Design/Development Research International Conference 2016 (SEA-DR 2016).

On behalf of Universitas Negeri Padang, let me welcome all of you to the conference in Padang, West Sumatra Province, Indonesia. We believe that from this scientific meeting, all participants will have time to discuss and exchange ideas, findings, creating new networking as well as strengthen the existing collaboration in the respective fields of expertise. In the century in which the information is spreading in a tremendous speed and globalization is a trend.

Universitas Negeri Padang must prepare for the hard competition that lay ahead. One way to succeed is by initiating and developing collaborative work with many partners from all over the world. Through the collaboration in this conference we can improve the quality of our researches as well as teaching and learning process in mathematics, science and technology.

I would like to express my sincere appreciation to Graduate Programme of Mathematics Education, FMIPA UNP and organizing committee who have organized this event. This is a great opportunity for us to be involved in an international community. I would also like to extend my appreciation and gratitude to keynote speakers, parallel keynote and participants of this conference for their contribution to this event.

Finally, I wish all participants get a lot of benefits at the conference. I also wish all participants can enjoy the atmosphere of the city of Padang, West Sumatra.

Thank you very much

Prof. Dr. Phil. Yanuar Kiram
Rector

Message *from the* Dean of Faculty of Mathematics and Science Universitas Negeri Padang

Rector of State University of Padang
Vice-Dean of Faculty, Mathematics and Science
Head of Graduate Program in Faculty of Mathematics and Science
Head of Department in Faculty of Mathematics and Science
Distinguished Keynote Speakers
Organizers of this conference
Dear participants
Ladies and gentlemen

I am delighted and honored to have this opportunity to welcome you to SEA-DR International Conference 2016, which is hosted by Graduate Programme of Mathematics Education Faculty of Mathematics and Science, Universitas Negeri Padang.

As the Dean of Faculty of Mathematics and Science, I wish to extend a warm welcome to colleagues from the various countries and provinces. We are especially honored this year by the presence of the eminent speaker, who has graciously accepted our invitation to be here as the Keynote Speaker. To all speakers and participants, I am greatly honored and pleased to welcome you to Padang. We are indeed honored to have you here with us.

The SEA-DR 2016 organization committee has done a great work preparing this international conference and I would like to thank them for their energy, competence and professionalism during the organization process. For sure, the success I anticipate to this conference will certainly be the result of the effective collaboration between all those committees involved.

This conference is certainly a special occasion for those who work in education, mathematics, science, technology, and other related fields. It will be an occasion to meet, to listen, to discuss, to share information and to plan for the future. Indeed, a conference is an opportunity to provide an international platform for researchers, academicians as well as industrial professionals from all over the world to present their research results. This conference also provides opportunities for the delegates to exchange new ideas and application experiences, to establish research relations and to find partners for future collaboration. Hopefully, this conference will contribute for Human and Natural Resources.

I would like to take this opportunity to express my gratitude to all delegates for their contribution to the SEA-DR 2016.

Thank you,

Faculty of Mathematics and Science
Prof. Dr. Lufri, M.S.

Message *from the* Chairman of Organizing Committee

First, I would like to say welcome to Padang Indonesia. It is an honor for us to host this conference. We are very happy and proud because the participants of this conference come from many countries and many provinces in Indonesia.

Ladies and gentlemen, this conference facilitates researchers to present ideas and latest research findings that allows for discussion among fellow researchers. Events like this are very important for open collaborative research and create a wider network in conducting research.

In this conference, there are about 118 papers that will be discussed from various design/development researches and about 215 participants will join this conference.

For all of us here, I would like to convey my sincere appreciation and gratitude for your participation in this conference.

Thank you very much

Dr. Irwan, M.Si
Chairman

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DEVELOPMENT OF MATHEMATICALPROBLEM-TYPE OF PISA USING CULTURAL CONTEXT NORTH SUMATRA FOR JUNIOR HIGH SCHOOL

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Abstract

This study aims to explain the characteristics of mathematical problem type of PISA using cultural context of North Sumatra for junior high school students are valid and practical.This type of research is development research type development study. The development model used is a model Plomp. Known about the validity of the results of expert judgment that declared valid content, construct, and language as well the through the question item validity. While practicality is question known from the results of one-to-one evaluation dan small group. From the results showed 13 types of PISA math problems using the cultural context of North Sumatra valid and practical in accordance with the characteristic which has been specified.
Keywords : Development research, Problems Mathematics type PISA , Cultural North Sumatra.

INTRODUCTION

Programme for International Student Assessment (PISA) is the assessment programs student of level international organized by *Organisation for Economic Cooperation and Development* (OECD). PISA aims to assess the extent to which students sit in the year end of primary education (students aged 15) has mastered the knowledge and skills necessary to be able to participate as citizens or members of the public who build and responsible (Shiel, 2007).

PISA orientation is more concerned with what students can do rather than what they are learning in school. Therefore, it is expected that students have the literacy skills of mathematics. Mathematical literacy is defined as the someone ability to be able to formulate, implement, and interpret mathematics in various contexts, including the ability to perform reasoning mathematically and using the concepts, procedures, and facts to picture, explain or predict phenomena / events (OECD, 2009).

Understanding literacy mathematics PISA is above in line with the goal of math lessons contained in Permendikbud No 58 of 2014 which states that the skill or proficiency of mathematics is part of the life skills of the students, especially in the development of reasoning, communication, and solutions to problems encountered in student life. Each individual needs to have a mastery of mathematics at a certain level. Individual mastery thus basically not pengusaan mathematics as a science, but the mastery of mathematical skills (mathematical literacy) needed to understand the surrounding world and to succeed in life or career. This means, mathematical literacy skills need to be trained to students.

In fact, based on the results of field teachers observations more often give routine matters that are not contextual and more emphasis on memorization raw formulas without the application of mathematics in everyday life. At the time of evaluation, the given problem is not varied, only revolve around the question of what, how many, determine, finish. Rarely to use the word why, how, where, or when, so that the creativity of students is less explored and students are not trained to express opinions or ideas in their minds. Here's one example problems used teachers to evaluate students in the learning process.

Jika $y = 2 + 6x - 3x^2$, nilai y untuk $x = 3$ adalah …

Picture 1 : Example problems used teachers evaluate students in the learning process

Problem in picture 1 is more emphasis on raw technical ability or the ability of procedural, not equip students in solving the problems of everyday life and do not train the students' skill mathematical literacy.

Evident from the results of the achievement of the skill literacy mathematical of Indonesian students in the PISA survey. PISA survey results from the year 2000 to 2012 which showed that Indonesian student achievement in mathematics has not been satisfactory.

Indonesian student achievement in the PISA survey should be a whip for the government to conduct a review of the quality of teachers, learning resources, evaluation systems, support communities, stakeholders or the government itself.

The result of low student literacy is caused by many factors, one of which is teachers are not accustomed to or even never give problems such as PISA questions to the students. Related to contest math literacy the teachers rarely engage students in the literacy contest. Yet through mathematical literacy contest, students and teachers can get to know the problems characteristic PISA because usually the questions tested are problems math refers to standard PISA.

The importance of socialization problems PISA has been done by the government through Kemendikbud pointing Tim PMRI (Indonesian Realistic Mathematics Education) to socialize about PISA through activities called Contest Literacy Mathematics (KLM) so that teachers can develop the literacy skills of students through the completion of the questions focus from PISA.

Teachers also had difficulty designing mathematical problems using a context that is close to the students environment consequently students less interpret mathematics in everyday life. The problems of daily life related of mathematics aplication can be solved using mathematical literacy skills. The skill of literacy helps a person to recognize the role of mathematics in life and make judgments and decisions required as a citizen (OECD, 2010). Then It's important to activate students' mathematical literacy because it is one aims of the mathematics learning to be achieved.

From some problems along with solutions that have been previously disclosed, the result is achieved is not yet optimal. Therefore, the solution given is not enough just to hold a literacy contest but need socialization of teachers, students, or parties related to how to develop the contextual problems that meet the characteristics of such problems PISA.

Contextual problems also need be faced the students. The importance complete of a math problem using direct context is one of the ways that can be used so that students have the skills needed to live in the present century (Lutfianto, et al, 2013).

According Retnowati (2010: 43), the real context that is meaningful to students in something an area may be different from other areas so using appropriate real context is recommended because it helps students to perceive and interpret information more easily. One context that is close to the students is the cultural context.

PrinciplesofCurriculumImplementation in Government Regulation No. 19 Year 2005 on National Education Standards curriculum is implemented by utilizing the natural conditions, social and cultural as regional wealth to educational success with payload throughout the study materials optimally, including mathematics.

In this study, the context used is the cultural context of North Sumatra as research subjects were students in the city of Medan. Cultural context North Sumatra that is used is the Tor-Tor dance, musical instruments gondang, Ulos cloth, cupcakes, sculpture teacher Patimpus, clothing sultanate deli, attractions in Brastagi. These contexts obtained based on the analysis of the characteristics of the students.

Based commentary on the above, it is necessary to the development of mathematical question using the PISA type of cultural context of North Sumatra. Although previous research has been done about the development of the model PISA using context Lampung (Son, 2015). However, the validation problem is only done by the experts. While the condition test of a good test to be valid (qualitative and quantitative), reliable, objective and practical (Purwanto, 2004).

The purpose of this study is to describe the characteristics of math problems using the PISA type of cultural context of North Sumatra for junior high school students are valid and practical.

RESEARCH METHODS

This type of resear is the *development research type development study.* The development model used is a model Plomp. Plomp development model consists of three stages, namely, *preliminary research, prototyping phase,* dan*assesment phase* (Plomp and Nieveen, 2013:30). But in this study only reached the stage of *prototyping phase* as adjusted on the research objectives of the foregoing.

At the stage *prelimanary Researh*, conducted a needs analysis, analysis of student, context analysis, and analysis of the curriculum. Next the results of the preliminary stage of material used in making the device covering grating questions, questions and answer keys, and the assessment rubric. The results of the so-called designing prototype 1. The next stage is the stage of development (prototyping phase). After the first complete prototype design, development continued with formative evaluation that begins with a self-evaluation, expert review, one-to-one evaluation, small group, and a field test (Tessmer, 1998).

The first step is *self-evaluation*. At this stage their own assessment of the prototype 1. The results of the revision of the self evaluation is called a prototype 2. Further validation was done by an expert to assess the prototype 2 in terms of content, construct, and language. Revision of the so-called expert-review prototype 3. Then protitipe 3 evaluated through one-to-one evaluation. The evaluation was conducted to assess the practicality of matter, in terms of legibility, instructions for use matter, clarity of images, tables, graphs, and timeliness. Revesi results of this phase is called the prototype 4. One final development phase of testing small groups (small group). Prototype 4 in ujicobakan one class outside of the subject tests on assessment stage. The goal is to obtain valid and reliable questions quantitatively. In addition, the small group phase also aims to see the practicality in terms of time, adjusted for the given question. The results of this phase is called a prototype 5.

Protitipe 5 are the questions that have been declared valid and practical. The questions are tested on test subjects who have been established, namely, a class IX student of SMPN 1 Medan, SMPN 2 Medan, and SMPN 24 Medan.

Data collection instruments used in the preliminary research stages, namely, interview guides, observation sheets, and the check register. While the instruments of collecting data at the stage of prototyping phase, namely the check list (self evaluation), validation sheet (expert review), interview guides and questionnaires (one-to-one evaluations), and the question package (small group).

Data analysis techniques obtained from interviews and field notes were analyzed with a model of Miles and Huberman. Data obtained from the check list, self evaluation results, suggestions / comments of experts, and interview guides were analyzed descriptively. While the data obtained from the sheet the validation and assessment sheet instruments filled by experts analyzed using the formula

$$R = \frac{\sum_{i=1,\ j=1}^{i=m, j=n} V_{ij}}{mn}$$

(Muliyardi, 2006:82)
Information:

R = the average of the assessment result of the experts / practitioners
V_ij = score assessment the experts / practitioners all of the criteria j-th
n = number of experts or practitioners who judge
m = many criterion.

Devices developed about the three criteria of being taken of the criteria proposed by Nieveen (2007: 94)namely, valid, practical, and effective. The instrument is said to be valid if the validation results of the experts say the questions that were developed are valid both in terms of content, construct, and language. Other than that the instrument said to be practical if the issue can be used by all educational practitioners and experts who becomes validator stating that the questions that are developed can be applied. While the instrument is said to be effective (Van den Akker, 1999: 10) when expert / practitioner based on his experiences stating that the instrument (matter) have effect on students' mathematical abilities which in this case is theability of reasoning and communication.

RESULTS AND DISCUSSION

Research Result

The result Phase *Preliminary Research*

Preliminary research stage starts from the needs analysis, analysis of student, context analysis, and analysis of the curriculum. The results of the needs analysis obtained information that the difficulty of designing questions that contain contextual indicators mathematical reasoning and communication so that students are more often given routine matters more emphasis on standard techniques alone.

Analysis of the students performed to determine the characteristics of the students. The first characteristic, analyzed by age, the class IX students enrolled in the second semester of the Academic Year 2016/2017 in age range 14-15 years.

The second characteristic, analyzed based on the learning process experienced during this time, that is if the teacher provides questions that more emphasizes the use of rote formula, most students are not motivated to work on the question and find it quickly saturated. The third characteristic, analyzed by neighborhood, most of the students are the descendants of the tribe of Batak. Batak tribe has several dance and traditional musical instruments that are still popular today. These characteristics are used in the development of questions that uses Tor-Tor dance context.

The fourth characteristic, most of the students lived not far from the center of Medan. Fifth characteristic, most students know the food typical of the city of Medan, the sixth characteristic, most students have the same object of tourist destinations and frequently visited on holidays. The characteristics were found to be material in the development of type PISA math problems using the cultural context of North Sumatra.

Context analysis aimed to determine the context of the problems in accordance with the characteristics of students who have been found. The final analysis is the analysis of the

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curriculum. The results of the analysis of the curriculum is the basis that the problems that developed in general have been studied by students. Based on the analysis of the curriculum, the questions that have been designed to load all of the aspects contained in the scope of the subjects of mathematics in the educational unit SMP / MTs.

Results Prototyping Phase

The development is based on a matter framework of PISA 2015 that includes indicators of mathematical reasoning and communication. The questions are designed based on common characteristics of students in Medan. The design of the initial products include the manufacture of lattice matter, a matter of form*selected-response (multiple- choice) items*, *closed constructed-response*dan*open-constructed respons item* key answer and scoring rubric. The results of the preliminary design called the prototype 1 1. Further evaluation (self-evaluation). Revision of the self evaluation is called a prototype 2. One question on the product at the prototype 2 before being validated can be seen in picture 1.


Soal no 3

SEPERANGKAT ALAT MUSIK "GONDANG"

Gambar 3. Seperangkat Alat Musik *Gondang*

Toko alat musik HORAS mempunyai seperangakat alat musik "*Gondang*" yang akan dijual seharga Rp.30 juta. Toko HORAS memberikan beberapa potongan harga/diskon untuk menarik pelanggan, yaitu sebagai berikut.

Diskon I : 5%

Diskon II : Rp. 0,50

Diskon III : $\frac{1}{5}$

Jika pelanggan diperbolehkan memilih diskon yang diberikan. Diskon manakah yang akan membuat harga jual barang tersebut menjadi lebih murah? Jelaskan alasanmu.

Picture 1. One of Product on Prototype 2

Expert Reviews

This stage involves some validators namely, Prof. Dr. Hasratuddin Siregar, M.Pd of UNIMED, Dr. Indra Jaya, M.Pd of UIN-SUMUT, Prof. Dr. Syahrul R, M.Pd of UNP, some colleagues who participated validate the questions developed.

Based on the validation by experts and peers, it can be concluded math question type PISA using the cultural context of North Sumatra is valid but with some improvements. For example related of question command sentences. One example is, a matter of question command sentences in picture 1 improvement to be as follows. the result Revision of the experts called prototype 3.

Jika pelanggan diperbolehkan memilih diskon yang diberikan. Diskon manakah yang akan membuat harga jual barang tersebut menjadi lebih murah? Berikan alasanmu dari setiap alternatif jawaban yang kamu gunakan.

Picture 2. Results of expert repairs..

One-to-One Evaluation

Implementation of the one-to-one committed against three students of class IX who has mathematical abilities are different from each of the schools are different too. High school criteria (SMPN 1 Medan), moderate (SMPN 2 Terrain), and low (SMPN 24 Medan). Those criteria are obtainable based on the average value of secondary schools in the city of Medan Academic Year 2015/2016. So the implementation of one-to-one carried out against nine students.

Objective one-to-one evaluation is a matter based ofpracticality see student assessment. First, students are asked to do 21 questions for 120 minutes. Furthermore, students were interviewed one-on-one for the requested comments and suggestions on the question package, in terms of both manuals, questions, question commands, and the answer. However, not all students advice received. Suggestions students rejected if change indicator questions that have been set. The suggestions of the students are used to improve the prototype 3. The result of the revision at this stage is called a prototype 4.

Small Group

This stage aims to generate questions that Valid and reliable. Experiments conducted on students in class IX MTs Laboratory UIN-SU. Students are asked to complete 21 questions with a duration of 120 minutes. The results of tests of a small group, obtained 13 valid questions and has a reliability coefficient of 0.624 with high reliability category. The results of this phase is called a prototype 5.

Based on the advice of experts and teachers, it was concluded that the number of questions used in the field test (field test) in the assessment stage as many as 13 questions with a duration of 100 minutes.

Field Test

Field test done to see the effectiveness of the questions that have been developed. However, based on research objectives have been set that describes the characteristics of math problems using the PISA type of cultural context of North Sumatra valid and practical, the stage of development only to a small group trial stage (small group).

The result of this development generates 13 questions were valid and practical with characteristics .

Discussion

The validity of Mathematical question type PISA using Cultural Context North Sumatra

Aspects of the validity of visits by content validity, construct, and language. PISA math problem said to fulfill the type of content validity, if it has been developed in accordance with state of the art. This means that these matters have been developed in accordance with aspects related to the development of the theory of mathematical problems, the characteristics of the students, PISA framework, the cultural context of North Sumatra, and the school curriculum. These questions are said to have met the construct validity if the problems have been developed in accordance with the provisions of such conformity with the presentation and kegrafikan predetermined (Nieveen, 1999: 127-128). Validity problems are also seen by aspects of language that has been set in the guidelines is the development of instruments (MONE, 2008). In addition validity matter is also seen from the item question analysis (validity and reliability problems) (Purwanto, 2004).

Under terms of the validity, the mathematical problems using the PISA type of cultural context of North Sumatra as valid if it fulfills the content aspect, constructs, language, and analysis of items that have been set.

Based on the results of the validation by experts, obtained on the aspects of content, namely the problems that have been in accordance with the material in kurukulum school, student characteristics, indicators of reasoning and mathematical communication, prepared in accordance domain content PISA (shape and space, quantity, change and relationships, and uncertainty and data), and has a difficulty level of questions ranging from level 3 to 5.

Furthermore, the results on the aspects of the construct, the questions have been prepared in accordance domain context PISA (occupational, personal, and societal), domain process (formulate, employ and interpret), briefing about the question obvious, there is a scoring rubric, if the question using pictures, charts, or tables can be read aloud, and writing the terms, symbols and mathematical equations are correct.

The aspect last namely aspects of language. Based on the expert validation results obtained mathematical question the type PISA using of sentences according EYD, communicative about the sentence, appropriate understanding of the students, do not use the word / phrase that pose a double interpretation, and limits the obvious question. The results of data analysis for the three aspects of the validation sheet obtained an average score on each item statement ranged from 2.4 to 3.4 with a valid category. While the items obtained from the analysis of 13 items that valid and has a reliability coefficient of 0.624 with high reliability category.

Based on the results of the overall study of the obtained 13 math problems types PISA uses cultural context of North Sumatra valid with criteria, 1) the problems are presented according the framework PISA 2015 consists of the content *space and shape, quantity, change and relationship,* and *uncertainty and data*, konteks*occupational, personal,and societal, and questions began to level 3 to 5*, 2) problems in accordance with the characteristics of the students, 3) most of the material in question has been studied by students, 4) the matter has been appropriate indicator of the ability of reasoning and mathematical communication students, 5) problems are presented using the cultural context of North Sumatra, 6) the provision of images / illustrations to help students understand and know the problems about, 7) instructions for using the problem clearly and words matter in accordance with the rules of writing, Indonesian, 8) the use of symbols and mathematical equations using appropriate typeface, 9) each presentation of information / data that is considered important give boldface..

Practicalities of Mathematical question type PISA using Context Cultural North Sumatra

Practicalitas the question practicalities relating to the students. Purwanto (2004) test is practical if easy to implement, easy examination and include clear instructions. Problem is said to be practical if it has to be used on the actual situation (Nieveen, 1999). Questions are also said to be a practicalwhere activities are implemented in accordance with the time that has been provided, and the emergence of motivation and attraction of students to question (Sukardi, 2008: 52).

Praktikalitiasobtainedafter the implementation of the evaluation of individuals and small groups. Based on the evaluation of experts, teachers, and students can be concluded that the math problems using the PISA type of cultural context of North Sumatra have been practical. These questions make it easy for students and teachers to explore the capabilities of reasoning and mathematical communication students, the questions types PISA raises the attractiveness for students to do, the time required in the implementation according to the time available, and instructions for using the problem clearly.

CONCLUSIONS AND SUGGESTIONS

Based on the results of research and discussion, it can be concluded that it had generated 13 questions that meet the characteristics of math question the type PISA using of cultural context of North Sumatra valid and practical. These questions have been valid in qualitative terms of content, construct, and language derived from the results of expert assessment and practical assessment given by students and teachers valid as quantitatively and reliable.

Based on the research results and conclusions that have been raised, it is recommended to further research in order to measure the effectiveness of the questions that have been developed through several intervention / treatment of the students. From the results of these interventions is expected to provide a good impact on the ability of mathematically-mathematically the students.

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Realistic Mathematics Education (RME) As An Instructional Design Approach for MAN 4 Jakarta Eleventh Grader Students Majoring in Scientific Studies to Build The Relational Understanding of Integral

Novianti Mulyana,M.Pd., Dr. Anton Noornia, M.Pd.
MAN 4 Jakarta and UNJ, Jakarta, Indonesia; State University of Jakarta

Abstract

This is a Development of a Design Research Thesis by Novianti Mulyana 2015 about Integral for social studies student, that had a further development in SEAMEO QITEP Lesson Plan Competition 2016 then it was applied for the other group of natural science students in MAN 4 Jakarta. The purpose of this research is to develop a Local Instructional Theory using RME as a more effective Local Instructional Theory to build students' relational understanding of Integral that not only suitable of social studies students but also for natural science studies. This research is using The Design Research Method which consists of three cyclic phases which are preparation and design, teaching experiment, and retrospective analysis. The contexts that are used in this research are the derivative of a function and wall paper. The retrospective analysis shows that the context used, mathematical process, and the activity of the students and teacher proved to be able to build students' relational understanding, with contexts as the tools in thinking activities from the "model of" to the "model for" that is more effective for students to directly work on the worksheets by themselves. The result of this research is proved by the ability of students to explain the fact of the process and results of his/her work and find their own method to solve the problems.

Keywords: RME, effective lesson plan, relational understanding, Integral, wall paper.

INTRODUCTION

A. Background

The mathematics learning objectives in Indonesia correspond to the NCTM (*National Council of Teachers of Mathematics*): 1) *problem solving*, 2) *reasoning*, 3) *communication*, 4) *connection*, and 5) *representation*, that can be achieved by learning mathematics in school from elementary, junior high, to senior high school. Students of twelve graders of MAN 4 Jakarta at the early 2015 still had difficulties in several mathematical materials, such as Integral in Calculus.

The difficulties that experienced by the students correspond with the 20 years of research compiled by Kizito (2012), that the students don't have the relational understanding about Integral, yet. Students could solve and answer procedural problems, but struggle to solve the conceptual problems, and they didn't even try to solve it. It was probably caused by the learning process. Anthony and Walshaw (2009) stated that learning activities which lack of students engagement will cause the students struggle to be able to solve mathematical problems. The learning objectives can be achieved by building a condition of fun learning and learning understanding using context that can be the previous understanding (Heuvel-Panhuizen, 2001), which can be achieved by using the Realistic Mathematic Education (RME) approach. RME uses guided reinvention method and contextual problem (Gravemeijer, 1999). The context gives the opportunity to students to develop mathematical understanding by changing from "model of" to "model for". Students can do an intertwinement that connects the new math material with the math material which had been understood, followed by interactivity with other students and teacher.

Solving a math problem with a self-chosen strategy, can be conducted with relational understanding. Relational understanding in this research is reconstructed from Skemp by Kinach (2002): 1) *Content level understanding*, 2) *Concept level understanding*, 3) *Problem solving level understanding*, 4) *Epistemic level understanding*, Relational understanding occurred when someone can use a mathematic procedure using the mathematic concepts that he/she has understood, and then can make the relation among what to be learnt with what has been understood. Learning with the Realistic Mathematics Education (RME) approach can give the opportunity to construct the relational understanding. The local instructional theory of Integral subject using RME approach can be built using a Hypothetical Learning Trajectory by a Design Research.

After applied for students majoring in social studies, then the local instructional theory then applied for students majoring in science studies. Then in the QITEP for math lesson plan competition this lesson plan has been developed to be more effective and efficient so it will be easier for students to directly doing the activities in the worksheets since the problems and activities had been more carefully chosen according to the idea of integral that has to be mastered by students. That is why the development of Design Research*:* Realistic Mathematics Education (RME) As an Effective Instructional Design Approach for MAN 4 Jakarta Eleventh Grader Students Majoring in Social Studies to Build Relational Understanding of Integralwas conducted.

B. Research Question

"How to develop Realistic Mathematics Education (RME) As An Effective Instructional Design Approach for MAN 4 Jakarta Eleventh Grader Students Majoring in Scientific Studies to Build Relational Understanding of Integral?"

C. Restriction of Terms

According to the reconstruction of understanding from Skemp by Kinach (2002) and the Minister National Education Indonesia number 22nd year 2006 about content standard for Elementary and High Education Unit, the development of relational understanding is restricted to*:* 1) *content level understanding* (can show the basic facts using algorithm)*,* 2) *concept level understanding* (can analyze and synthesize patterns), 3) *problem solving understanding* (can use scientific method to solve problem independently), 4) *epistemic level understanding* (can give valid mathematics proves). The mathematics content in this research is the part of Integral for scientific and social studies major in Senior High School that is Definite Integrals.

D. Research Purposes

The purpose of this research with a *Design Research* method is to develop Realistic Mathematics Education (RME) As an Effective Instructional Design Approach for Eleventh Grader Students Majoring in Scientific Studies and/or Social Studies to Build Relational Understanding of Integral.

E. Research Use

1. The use for Students

The research use for students is to escalate the quality in mathematics learning process in Integral with Realistic Mathematics Education (RME) As an Effective Instructional Design Approach for Eleventh Grader Students Majoring in Scientific and/or Social Studies to Build Relational Understanding of Integral.

2. The use for Teachers

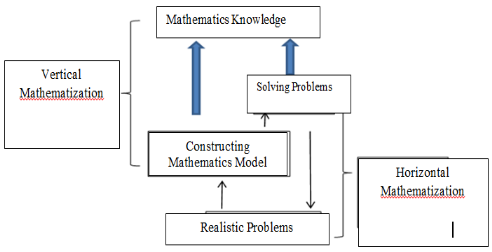
The strategy and learning design that developed in this research can be used as an alternative in teaching. Teachers can use the Local Instructional theory in this research, so he/she can be more focused in doing the fun learning activities effectively.

I. Theoretical Review

A. Relevant Theory

1. Realistic Mathematics Education

Realistic Mathematic Education (RME) was developed since 1971 by the mathematician Hans Freudenthal in the Netherlands. Gravemeijer and Terwell (2000) support this learning approach with their opinion that learning mathematics will be more meaningful for students if started with the investigation about man activities. Furthermore Heuvel-Panhuizen (2001) explain that realistic is not only a situation in the real world, but also things that can be visualized by students such as stories and formulas. Using contexts help students to construct mathematics concepts, because the new mathematics concepts that has to be learnt is easy to be connected with the prior knowledge. In order to achieve understanding, activities to connect the new knowledge to the prior knowledge is important since mathematics is not to be given as a final formula that is ready to be used (Gravemeijer and Terwel, 2000). Understanding can't be given by teacher to students. It has to be constructed independently by students (Lynn, 1999). Understanding can be constructed by directing students to reinvent mathematics ideas or concepts by mathematical process by solving realistic mathematics activities. This is supported presentation by Heuvel-Panhuizen (2001) that when working with contextual problem, students develop mathematical process and understanding.



Picture 2.1. Reinvention in RME

Gravemeijer (2000) stated that the RME principles are:

a. Guided reinvention an progressive mathematization, to find the independent way to solve mathematics problems
b. Didactical phenology (the use of phenomena in learning math)
c. Self-development model

The principle of RME is supported by five characteristics presented by Treffers (in Gravemeijer, 1994):

a. Using context

The context not only as an illustration, but furthermore the contexts are really used as the tools to reinvent mathematics context. Heuvei;-Panhuizen (2001) presented that context is the important thing in learning use the RME approach, since has the functions as follows:

1. Concept forming gives the opportunity to students to reinvent concept naturally using context.
2. Model forming make the context can be used by student to develop many strategies to reinvent mathematics concept.
3. Sufficiently flexible to be applied makes the context can give the opportunity to students to see the application of it in the real world
4. Fit with the students' informal strategies means that Students use context to explore and to explain about the solution using context as the tools to solve problem.

b. Use models to Progressive Mathematization
c. Using the Students' Construction
d. Interactivity
e. Intertwinement

According to those experts opinion, so the learning activity that use the RME approach has to be started with context from the real life of the concepts that had been understood by the students, and then followed by the discussion to solve the problems to get the solution of the problems, eventually student can reinvent the mathematics concepts independently.

2. Integral Learning

Ryan (2005) presented that Integral is a part of Calculus. The definition of calculus is parts of mathematics that analyze the aspects of changing in process or system that can be modeled by function, using two primary tools namely derivatives and integrals. Differentials and integrals emerge from the idea of limit; develop from the function concept in the intervals decreasing to almost zero. The relation between differential and integral, known as the fundamental theorem of calculus, founded at the end of 17^{th} century independently by Isaac Newton and Gottfried Wilhelm Leibniz. Purcell (1996) presented that the fundamental theorem of calculus connect the gradient problem with the wide area problem. Indefinite Integral is an anti-differential.

B. Instructional Local Theory

The purpose of this design research is to develop a local instructional theory to construct relational understanding students in the realistic mathematics frameworks, which serves as a theory that is proven empirically on how a series of learning activity can be used for students majoring in social studies to build the relational understanding on Integral.

According to the presentation above, so this design research is arranged in 6 stages:

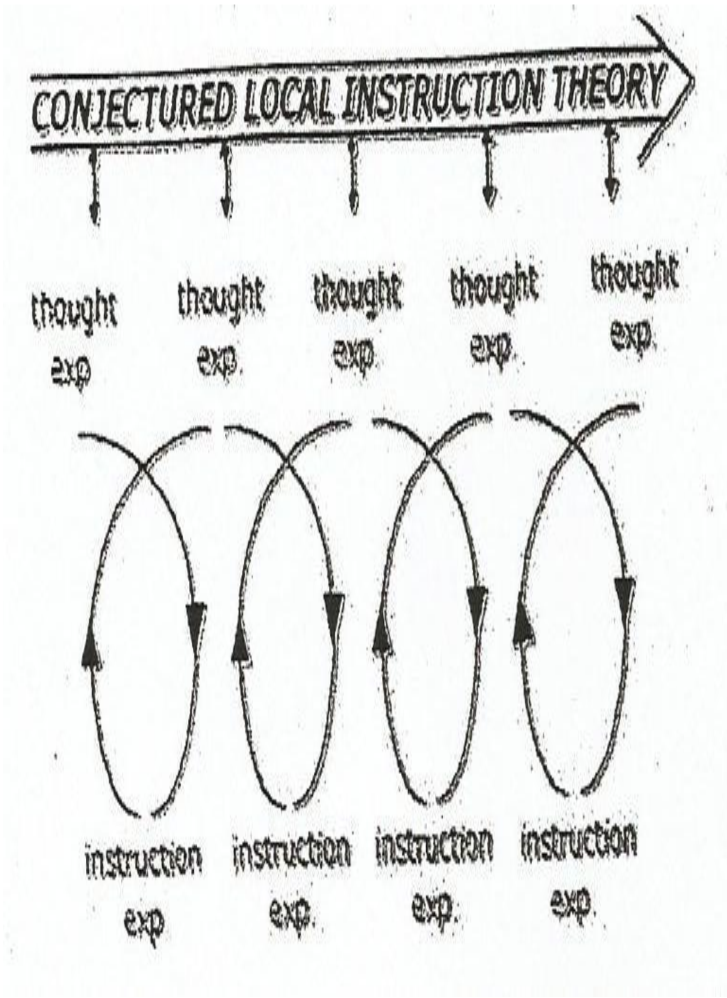
1. The first stage is a guided reinvention on a concept of wide area as the limit of additional the wide areas of rectangular which the wide of each rectangular very close to zero, so the numbers of the rectangular is near to infinity in the interval $a \leq x \leq b$ that use the model of hang wall paper.
2. The second stage Using the relational understanding that Integral is an anti-differential with the model of is polynomial function which the term in the polynomial function which consist of only a constant stated with two factors the characteristic and the variable powered by zero, to explain why the indefinite integral has to be added by a constant noted by C.
3. The third stage is using the relational understanding with the model of is the function that pass through a point (x, y) to find the value of the C in the anti-differential function
4. The fourth stage consists of activities to do the algebra manipulation using integral to find the wide area between graph and x axis in interval$a \leq x \leq b$.
5. The fifth stage is using the relational understanding with the model of is the definition of a function. The students understand the definite integral using substitution.
6. The sixth stage is using the relation understanding with the model of is the differential of the function of multiplication of two function, as the tools to understand the partial integration.

C. Hypothetical Learning Trajectory in this development design research only develop about the first and the second stage.

Hypothetical Learning Trajectory is made to clarify the Local Instructional Theory into mathematics learning activities in each meeting. There are nine meeting of learning, and one meeting of test in this design research, but in this development design research will be discussed only one meeting of two learning hours about integral as an area between curve and x axis, at the interval $a \leq x \leq b$.

II. RESEARCH METHODOLOGY

Bakker (2004) stated that design research has three phases: (1) preparation and design (thought experiment); (2) teaching experiment (instruction experiment); and (3) retrospective analysis (produce conjectured local instructional theory), that form a cyclic process in each phase also in overall of the design research.



Picture 3.1. The reflective Relation between Theory and Experiment

B. The Research Time and Venue

This research is conducted in the second semester of year 2015/2016 at MAN 4 Jakarta, and refined in the SEAMEO QITEP Lesson Plan Competition 2016 in Jogjakarta.

C. The Research Subject

According to the criteria of choosing the research subject such as the prior ability, the activity of students in the teaching experiment phase, so it was chosen six research subjects. Then it was discussed with the observer whether those six students are suitable to be chosen.

D. Collecting Data Method

The data collected in this research is the video recordings, photos, students' work, and field notes (log). The methods to collect data are: pencil and paper methods, interview methods, and ostensive methods.

E. Instrument Research

The research instruments are: (1) video tape, (2) work sheets, (3) audio recording, (4) fields notes, and (5) Hypothetical Learning Trajectory

F. Data Validity and Reliability

Validity and reliability in this design research is needed to get the research result that can be proven right and valid. There are two kinds of the data: validity ecology validity and internal validity. And there are two kinds of data reliability: external reliability and internal reliability.

III. **RETROSPECTIVE ANALYSIS**

A. Interpretation Framework

Interpretation framework is the part that explains the method used to analyze data of research result that is the series of learning process in the class community that related with the development of mathematical process. Gravemeijer (2006) stated that there are two criteria in interpretation framework, that is (1) the framework to interpret the development of students mathematical thinking process as the overall in a class, (2) the framework to interpret the development of students' mathematical thinking as an individual

B. Research Result and Data Analysis

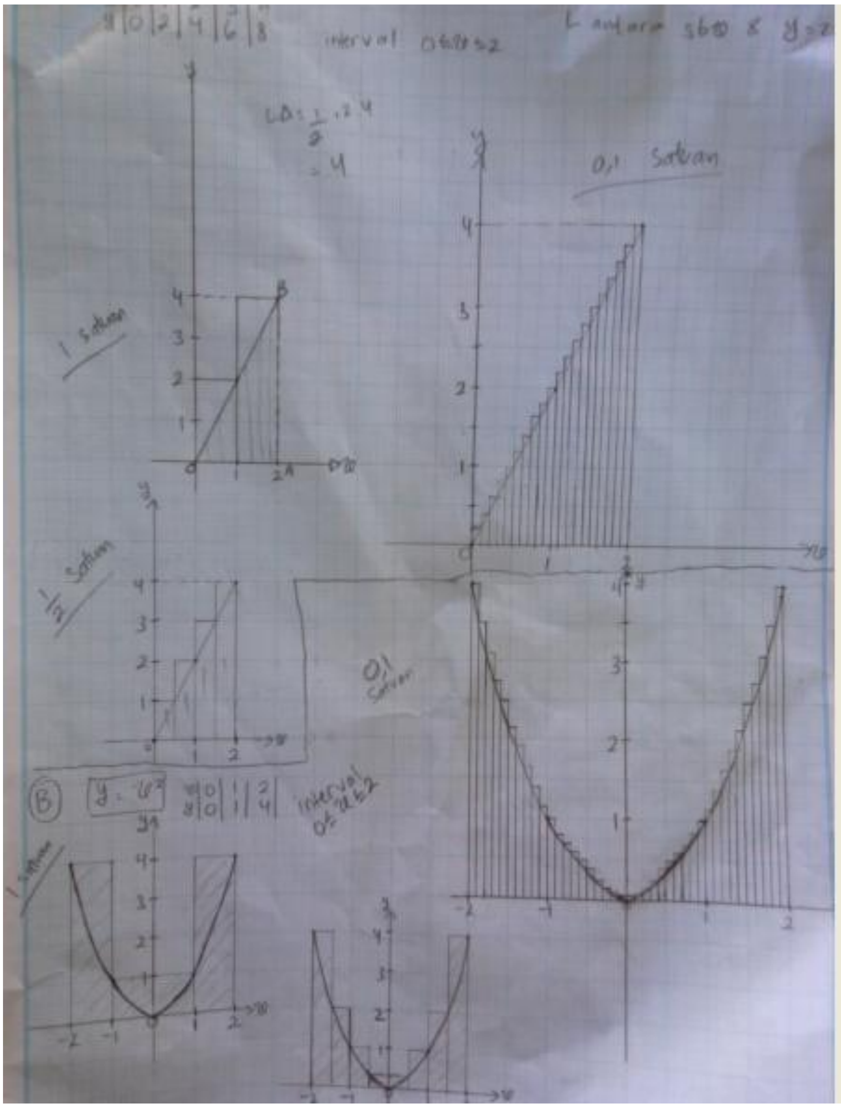
The following will be explained about the process of learning experiment in class and the data from it will be analyzed. The data analysis using the Emergent Perspective Interpretation Framework and will be explained for each meeting.

1. The first meeting in this developed (refined) design research (in the prior design research it was the fourth meeting): Understanding Integral as a wide area. Having the students had the prior knowledge about the wide area of regular shapes, learning activity continued

with the challenge to cover a wide area of a wall that has irregular shape with wall paper. The picture of how to hang wall paper was presented in the worksheet.

Picture 4.1. How to Cover Wall with Wall Paper (Courtesy from YouTube)

In the above picture, the students can see that the wall paper is long and can cover the wall to the highest part of the wall. The students then filling the worksheets on determining the wall paper needed to cover the area of the wall that the shape is a quarter of the circle area if the wide of the wall paper are 1 unit wide, 0.5 unit wide and 0.1 units wide. The students then analyze the results to answer which total area needs was the nearest to the wall area that has to be covered. After finding the result the students get the further question what will it be with the total area of the wall paper, if the wide of the wall paper decreasing? If the wide of wall paper is zero what is the total area of the wall paper? So what is the minimum wide of wall paper to get the nearest total area to the area of the wall that has to be covered? Amazingly, the students work on these tasks entirely, although they were not used to work on essay task. By actually doing this task, the student can analyze and come up with an idea that the technic on how to hang wall paper that the teacher offer will not be satisfied by the costumer since there will be area which not be covered.



Picture 4.4. Student's work on covering a wall with Wall Paper

The following activity is the teacher introducing the formal notation on what the students has been working on, as follows:

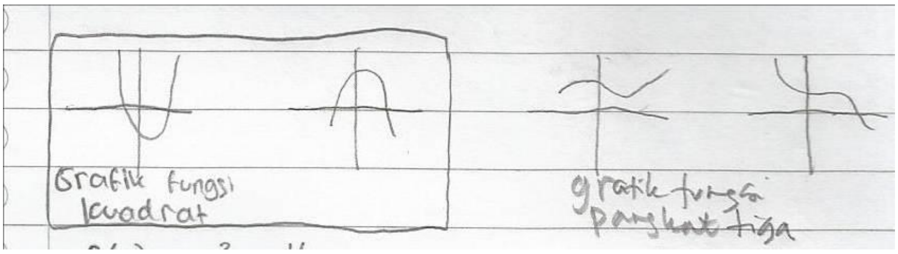
$$\lim_{\Delta x \to 0} \sum_{i=1}^{n} f(x_i)\Delta x = \lim_{n \to \infty} \sum_{i=1}^{n} f(x_i)\Delta x = \int_a^b f(x)\, dx$$

Formula 4.1. Definite Integral

By actually working to calculate the total wide area of wall paper with different wide, the students easily saw the idea of $\lim_{\Delta x \to 0}$ that affect to the increasing of the wall paper numbers that directed to the idea $\lim_{n \to \infty}$.

Students can easily see that using integral to determine the wide area is only the other way to find the wide area that is more effective to be used on irregular shapes.

2. A second part in the First Meeting: Integral as anti-differential



Picture 4.2. Students' Work about the Sketch of the Quadratic and the Third Power Function

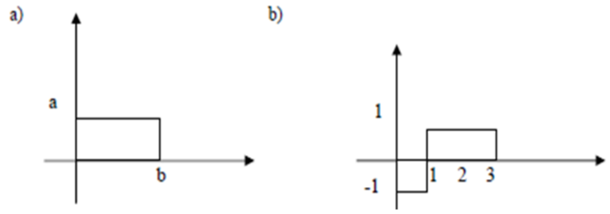
By using the idea that $x^0 = 1$ in discussion activities, students reinvent that since the differential of any constant is zero, the students find that the anti-differential of zero can be any constant number. By working backward the student find the pattern that anti differential of any polynomial function has to be added by a constant that noted by C.

3. The second meeting: Determine the wide area between above x axis and a graph and the wide area between under x axis and a graph

Using the wall paper, makes the students easily see the wide area has to be a positive value, since there is the wall paper needed to cover it.

4. The third meeting: The exercise on Definite Integral

Find the wide area of a) and b) using integral.



Picture 4.3. Problem adapted from Rosken and Rolka (2007)

The problems were not the regular problems but the problems that needed the understanding and can be solved without any algebra formula.

5. The fourth Meeting: Determine the Integral of function that passes through the point (x_i, y_i)

The students use the definition of gradient as the context in this meeting, and then use the definition of function that passes through a point.

6. The fifth Meeting: Integral to find the length of a curve.

The idea in the width of wall paper that is near to zero is becoming a model of, then student can easily imagine it in their mind to imagine a very small right triangle with delta s as the hypotenuse and the right sides of the triangle are delta x and delta y. By adding those very smalls delta s it will construct the length of the curve.

7. The sixth meeting: Integral with Substitution.

By using the definition of a function, students were easily solving the problem in this part.

8. The seventh meeting: Partial Integration

Since the students were already getting used to use their relational understanding to connect their prior knowledge with the new knowledge that has to be learnt. The students were working backward to find the result of Partial Integration.

9. The eighth meeting: The exercise of Integral Procedural understanding

The procedural understanding still needed to be mastered, since it is a part of relational understanding. The interesting thing that happened was the students could solve problems more independently.

10. The ninth meeting: Test the relational understanding of Integral

The test consists of four problems that are about the indefinite integral, analyzing the result of definite integral of a function, analyzing the wall paper needed to cover the wall, and analyzing the wide area between two curves.

But in this paper, only will be explained about the first meeting, since the meeting that had been discussed in the SEAMEO QITEP Lesson Plan Competition 2016 to be refined was the first meeting that will be a very solid foundation for students to think the further ideas of integral using the knowledge that they had understood by using the wall paper as the context of addition of a very smalls rectangular to construct the area.

C. Data Analyze

Research Subject (RS) Analyze

By using the effective lesson plan that is chosen carefully students can directly and easier to work on the activities from the worksheets, comparing to the students respond at the applied lesson of the previous design research. Not only RS1 who has a very good prior knowledge about differential content, the other RS also could find the pattern that lead to the idea of adding C as the constant value to the integral of a function, by using the definition of anti-differential as the context, since it was delivered in the middle of the idea of adding the area of wall paper to connect to the idea of integration. RS1 could understand the idea of the activities were to compare the wide area that were calculated by the prior knowledge formula and by the integration formula using wall paper as the tools to connect both formula. By observing the result of integration and comparing that result with the wide area of each wall paper which was constructed from the multiplication of total $x$with $f(x)$, RS1, RS2, RS3, RS4, RS5, and RS6 can see the relation between the integration result and addition of wall papers to solve the cost of wall paper that has to be disposed in the challenge to cover wall with wall paper.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

These learning activities give the students the easier opportunity to reinvent independently to build the ability of students to find their own mistakes, by comparing the result from their investigation of problems that has selected carefully and presented in a smoother order comparing to the previous local instructional theory in NoviantiMulyana's Thesis.

The students are happier to work on the worksheets, since it is a simple worksheet but it can make them easily to see that the purpose of the activities is to help them find the idea of integral as clear as possible. The use of context makes them easier to find the mistakes. Compare to the students who had done exercises on procedural problems who still can't get the idea that the area under the x axis has to be a positive value. So, if student is an iceberg, then the design research can reveal the potential of the iceberg under the sea surface that is bigger than the potential of the iceberg above the sea surface. The other finding in this design research is the students' works show that students try harder to solve the problems not just writing "I don't know" in their answer sheet.

B. Suggestion

1. Suggestions for teachers are:
   a. Teachers' role to guide students to follow the hypothetical learning trajectory. The consistency of teacher as facilitator has to be maintained, so the students realize that in the learning activity each students has to have an active role to understand the content and reinvent the concept independently
   b. Teachers have to really pay attention on the direction of context changing to formal mathematics, and give the guidance to ensure the reinvention.
2. Suggestions for other researchers are:
   a. Wall paper installation requirement has been changed into hang it until the highest point of the curve.
   b. The other researcher can develop the local instructional theory in this design research such as learning using the multimedia in an online classroom.

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APPLICATION OF COMPUTER NETWORK SYSTEMSMODULE AT THE STUDY PROGRAM OF COMPUTER AND INFORMATION TECHNOLOGY EDUCATION OF BUNG HATTA UNIVERSITY

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Abstract

This study is a descriptive analysis on the application of learning module currently valid and practical for the subject: Computer Network Systems. By using research and development method, this study applies 4D model (Define, Design, Develop and Disseminate). However, the disseminate model is not used herein. The module is implemented to the students as the users. Results of the study show that there are 42% of the students who get very good grade, 48% of the students get good grade, and only 10% of the students get satisfactory grade. This means that the learning process and the test related thereto have been successful. Based on the above data it can be concluded that the module is proven to be effective and suitable for teaching the subject: Computer Network Systems at the Study Program of Computer and Information Technology Education of the Faculty of Teachers Training of Bung Hatta University. The Module gives overview and input to the education providers, particularly the Chairman of the Study Program and the Lecturers of the subject: Computer Network Systems for improving the quality of learning at the Study Program of Computer and Information Technology Education in an interesting, easy and fun ways.
Keywords: *Learning Module, Computer Network Systems, Effective.*

INTRODUCTION

The process of learning in collage is not the same as learning in school. Learning in Higher Education is not merely the provision of material, topic, or strategic concepts, but also must provide a learning experience that allows students to study the development of self-reliance. One of the factors that can support student independence in learning is the availability of adequate learning resources. The learning resources may include textbooks, modules, job sheets, dictates lectures , and others .

Based on the observations and formal interviews were conducted to lecturers and students of PTIK in the lecture Computer Network Systems, obtain information that the students generally do not have a printed teaching materials in the form of structured. Lecture materials submitted are not structured according to the existing curriculum because it is still a piece of material each meeting uploaded on the portal lecturer. These irregularities cause the continuity of the material to be disrupted. This certainly can hinder the creation of a conducive lecturing process.

Students also revealed that the presentation of the material matching with the material that already downloaded in Portal Elusive. Lack of student involvement in building understanding of the concept resulted in students easily forgotten against the material. In addition , students are also difficulties in transferring their knowledge in a variety of contexts that adversely affects the student results. The Following is information on the results of student learning in the form of final grades in the lecture Computer Network Systems.

Table 1. Final Value of Computer Network System Student Program Educational Studies Informatics and Computer Engineering.

Value	Year 2012/2013		Year 2013/2014	
	Number of Students	Percentage (%)	Number of Students	Percentage (%)
A	4	8	2	5,4
A-	3	6	2	5,4
B+	4	8	0	0
B	8	16	5	13,5
B-	5	10	0	0
C+	5	10	2	5,4
C	5	10	4	10,8
D	11	24	18	48,7
E	4	8	4	10,8
Amount	49		37	

Source : Administration Prodi

Table 1 , shows that the percentage of students who score more than 65 (categories A and B) in the year 2013/2014 was 24.3%. Therefore , it can be said that the results of student learning is still low. Based on the information obtained through formal interviews to some students concluded that one cause of low learning outcomes is the unavailability of teaching materials in the form of a structured lecture modules.

Response to the phenomenon that occurs then the alternative solution is to develop a modular printed teaching materials. Through the use of the module is expected students are motivated to learn independently so that the lecture would be more effective and efficient because students are able to understand the material will be studied. Students active in learning , so no need to wait lecturers explain the material and be able to do practicum without the generous support of lecturers. The module has been developed through the validity and practicalities that are expected to lead the students to be actively involved in lectures.

Teaching materials are an important part of the learning process. This material can be used to determine the success of the learning process, achievement of the objectives and activities of learning. According to Majid (2006 : 173), The teaching materials are all kinds of materials that are used to help teachers or instructors in carrying out teaching and learning activities. The teaching materials can form of written material or not written. Their teaching materials , it is possible for students to learn a certain basic competencies regularly and systematically, so that students can master the whole and integrated.

Preparation of teaching materials aligned to all messages shown learning that will be given to students can be accepted the good. Therefore, the accuracy of content, provision coverage, the use of language and packaging or appearance should be a constituent attention. Accuracy content and material provision is made based on the concept or theory that is applicable in the field of science as well as in accordance with the sophistication of the science development. The use of language in compiling teaching materials is one that needs to be considered. The teaching materials must be presented in a logical and easily understandable language students.

About the content of good teaching materials, Majid (2006 : 174) states that the teaching material includes at least a few things, that is :

a. Instructions for teachers and students learn is how to learn and use teaching materials.
b. Competence to be achieved, be obtained from the indicators that have been formulated.
c. Supporting information , including a description of the material , pictures and illustrations.
d. The exercises consist of questions that relate to the material being studied

Broadly speaking Lufri (2007 : 176) describes the stages in the writing of teaching materials as follows.

a. Preparation is the determination of the students who will use it, collecting literature, establishing a common, selecting the content, structuring or framework.
b. Writing is after preparation for writing a teaching material has been regarded as sufficient, the writing can already be started
c. Editing is a script written repair is very important in the writing of teaching materials. For the results good script, could not happen at once, but requires repeated reading and editing. The editing teaching materials covering aspects of language and content,

the content aspect eg changing a word or term, improve sentences and improve paragraphs .

d. The trials script that is written script tested to readers (teachers and students) to obtain feedback about the drawbacks, eg the part that is less clear or confusing.
e. Products manuscript is the last step of the writing of teaching materials. The completed manuscript to printed and copied.

The teaching materials were used in the study consisted of several types and forms , either in the form of written or not written. The type of this teaching material, Majid (2006 : 174) describe more clearly, That is :

The teaching materials will be used in the learning of three forms, namely : (1) teaching materials print (printed) consisting of handouts, books module, student worksheets, brochures, leaflets, wallchart, photos / images as well as model / maket, (2) teaching materials hear (audio) such as tapes, radio , disc black and compact audio disc, (3) teaching materials hear audio visual perspective) such as video compact discs and movies as well as (4) interactive teaching materials such as compact disk interactive.

Each of these materials has advantages and disadvantages. To determine the type which will be used, a teacher must adapt to the conditions and the ability of school.

The module is one form of teaching materials. According to the Directorate of Vocational (2008 : 4) " module is one form of teaching materials that are packed full and systematic , in which includes a set of learning experiences are planned and designed to help students master specific learning objectives ". next, Nasution (2005 : 205) argues " module is a complete unit that stands alone and consists of a series of learning activities designed to help students achieve a number of objectives that are formulated with a special and clear". so , the module is a lecture material consisting of a series of lectures and arranged in a clear, systematic, attractive, and not rely on other lecture material which is structured to help students understand the material so that students are motivated to learn.

Suryosubroto (1983 : 17) explains that the module is the smallest unit of teaching and learning program that outlines in detail :

a. Instructional objectives to be achieved
b. Goals that will be used as the base of the learning process
c. The main points of the material to be studied
d. Position and function modules in the unity of a wider program
e. The role of the teacher in the learning process

f. The tools and resources that will be used
g. Learning activities that must be performed in sequence and lived pupils
h. Work sheet that must be filled by children
i. Evaluation program that will be implemented

Rosyid (2010 : 1) argues " Modules are printed teaching materials are designed to be studied independently by study participants. The module is also called the media for independent study because it has been equipped for self-study guide". The module provides the opportunity for students to learn independently, because each student will use different techniques to solve a problem. The independence of the student is expected to improve the thinking ability of students. By studying the module, the students can get to know the benefits and drawbacks, because the modules provide an evaluation to diagnose the ability of students.

RESEARCH METHODS

This type of research that will be done is research and development (Research and development / R & D). According Sugiyono (2010 : 407) , R & D is a research method that is used to produce a specific product and test the effectiveness of the product. The products that will be developed in this study is the lecture modules Computer Network Systems . This research aims to develop a Computer Network System modules are valid , practical , and effective in terms of content and construct. This module development procedure using 4 - D models proposed by Thiagarajan et al, in Trianto (2007 : 65). This model consists of four phases , namely the definition phase (define), stage design (design), stage of development (develop) , and the dissemination phase (disseminate).

1. The definition phase (define)

This phase is done in order to see the picture of conditions on the ground with regard to the learning process of Computer Network Systems at the University of Bung Hatta , then analyze the problem . The process is carried out as follows.

a. Analyzing the syllabus aims to determine whether the material taught is in conformity with the standards of competence and basic competences subjects.
b. Analyzing textbooks Computer Network Systems, to see the contents of the book conformity with the standards of competence and basic competences which must be accomplished students. The books have been suitable to be used as a reference for drafting and example problems and exercises on the modules will be developed.

c. Reviewing the literature related to module developmen.
d. Learning the characteristics of students to facilitate in preparing the module level language and level of difficulty of questions.
e. Interviews with colleagues and students that aims to identify the problems / obstacles are encountered in the field in connection with the course Computer Network Systems.

2. Design (design)

The results of the definition phase is used at the design stage. At this stage, actions to be taken is to design modules Computer Network Systems. The module contains standards of competence, subject matter, a summary of the material, sample questions, exercises guided, and a bibliography. Presentation materials module can be done in several meetings that have been adapted to the syllabus.

3. Development (develop)

At this stage the action taken is to validate, test the practicalities and effectiveness of the module ;

a. The validation phase

There are two types of validation used in this module, as follows :

- The validity of the content, that is, whether the module has been designed according to the course syllabus.
- Construct validity, namely the suitability of the components of the module with indicators that have been set.

Modules are already designed, consulted and discussed with experts materials Computer Network Systems and Educational Technology experts. Advice from experts is used to enhance the module. Validation activities carried out in the form filling module validation sheets and discussion to obtain valid module and unfit for use.

The aspects that are validated can be seen in Table 3.

Table 3. Validation Module

No.	**Aspect**	**Method of collecting data**	**Instrument**
1.	The material in Module	Provide validation sheet specialist Computer Network Systems, educational technology experts and linguists.	Validation Sheets
2.	Presentation		
3	Language and legibility		

b. The practicalities phase

Practicalities of a disposable module level by students and lecturers, by testing the modules that have been revised. Tests performed on a local one. The aspects that are practicalities can be seen in table 4.

Table 4. Practicalities Modul

Aspect	Method of collecting data	Instrument
Attractiveness	Providing practicalities sheet to students	Practicalitie s sheet
Development process		
Ease of use		
Functionality and usability		
Reliability		

The module is said to be practical if users have no difficulty understanding the material presented, easy examination and complete with clear instructions. If the result is not yet practical, improvements and improved results must be validated first. After the results were declared invalid repair, test praktikabilitas to repair. This was done to find a practical module.

c. The Effectiveness Phase

This phase is done after the module otherwise practical. Activity was focused on evaluating whether the module can be used to achieve effective in improving the quality and student learning outcomes. Aspects of effectiveness observed in the lecture using this module is student results. Indicators of the effectiveness of the module seen on some criteria.

Table 5. Effectiveness Modul

No	Aspect	Method of collecting data	Instrument
1.	The impact on learning outcomes.	Assessment of learning outcomes.	Test

If the module is not valid, practical, and effective, the revision on the part that is still considered insufficient. The result of this revision used as a benchmark in fixing the modules that have been developed. Then the result of this being the final result a series of expansion modules.

Measures such research can be presented in the following diagram :

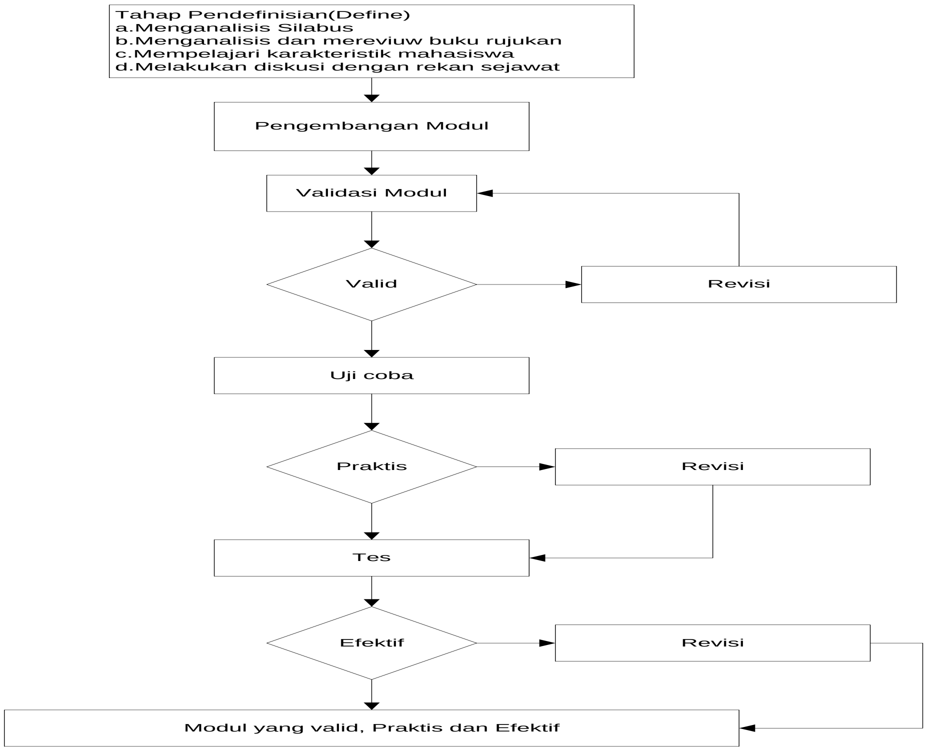

Figure 1. Steps Research

4. Trial Product

Product trials conducted to obtain data that will be used to revise the product in the form of modules. The test is done to the users about the quality module products that are being developed. In the development of this module Computer Network Systems , a test carried out in two stages , that is :

a. Small group trial involving seven students of Information Engineering and Computer Education .
b. The field trials

Data from this trial will be used as the basis for revising the product , so that the resulting product is really worth to be used in the lecture . Subjects trials in development research are students of Educational Informatics and Computer Engineering University of Bung Hatta with three categories as follows :

a. Students who have not taken the lecture Computer Network Systems
b. Students who passed (grades A, A- , B + , B , B- , C + and C) in the subject of Computer Network Systems .

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c. Students who did not pass (grades D and E) in the lecture Computer Network Systems.

5. Data Collection Instrument

The instrument used in this study include:

a. Validation Sheet

Validation Sheets is used to determine whether the modules and instruments that have been designed valid or not . Sheets validation module contains aspects that have been formulated . Each aspect is developed into several statements. Grading scale validation on the sheet using a Likert scale.

b. Practicalities Sheets

Practicalities Sheets with students aimed to determine whether the modules that are designed already practical or not. Grading scale validation on the sheet using a Likert scale.

c. Test

The test is used to determine student results after using the module. The test can be determined through the high and low scores in the form of learning outcomes.

6. Data analysis technique

Data obtained through various instruments analyzed qualitatively and quantitatively. The information obtained from the practicalities of modules were analyzed qualitatively. Data from the validation module sheet , Practicalities sheets , and test results were analyzed quantitatively study , descriptive techniques are then used to draw conclusions that are qualitative. Mechanical analysis of data from each instrument are described as follows :

a. Validation sheet

The results of the validation of the validator on all aspects assessed, presented in tabular form. Further requested the mean score by using the formula :

$$R = \frac{\sum_{i=1}^{n} V_i}{n} \qquad \text{(Muliyardi, 2006: 82)}$$

With : R = the average results of the assessment of the validator

Vi = score of the assessment results validator to - i

n = lots validator.

Then the average obtained confirmed the established criteria. How to get these criteria are as follows :

- The range of scores ranging from 0 to 4

- The criteria are divided into five levels. The term is used according to the relevant aspects .
- The range of the average interval is divided into five classes .

Then calculated the average of all aspects of the modules. To determine the level of validity modules used the following criteria :

- If the average > 3.20 then MODUL categorized as very valid.
- When 2.40 < average ≤ 3.20 then MODUL considered valid.
- When 1.60 < average ≤ 2.40 then MODUL categorized quite valid.
- When 0.80 < average ≤ 1.60 then MODUL considered less valid.
- If the average ≤ 0.80 then MODUL considered invalid .

2. Test Results Learning

Data obtained from tests of learning outcomes were analyzed by using a calculation the percentage of students who meet the minimum completeness criteria . The development of this module is said to be effective if more than 70 % of students getting grades 65-100 .

Table 6. Success Criteria Student Learning Outcomes

Criteria	Level of success	Percentage Range
Sangat sedikit	No success	1 – 25
Sedikit	Less successful	26 – 50
Banyak	Success	51 – 75
Banyak sekali	Very success	76 – 100

Source : Dimyati dan Mudjiono (2006: 125)

RESULTS AND DISCUSSION

To obtain valid module , carried out several stages according to model 4 - D set forth in Chapter III .The results obtained at each stage can be described as follows.

a. Define

This phase is carried out to see the picture of conditions in the field related to the lecture Computer Network Systems PTIK FKIP Bung Hatta University. At this stage, such measures syllabus analysis , analysis of textbooks , literature analysis , analysis of the characteristics of students and interviews with colleagues . The results obtained in the respective steps are as follows.

Syllabus Analysis

At this stage, an analysis of the course syllabus Computer Network Operating System on Education courses Informatics and Computer Engineering Faculty of Teaching and Education University of Bung Hatta .

Syllabus analysis performed to see if the material being taught is in conformity with the expected competencies . Based on the results of the analysis of the syllabus known that Competency Standards (SK) from this course are students able to use the basic concept and design of computer networks , communication protocols , network topology , the model - model of computer networks , the allocation of IP Address (subnet masking) and a connection to the internet.

Based on the analysis in the course syllabus , the module Computer Network System is developed for basic materials, the basis of computer network systems , namely Introduction to Computer Networks , Computer Network Operating System , Computer Network Protocol and Internet Protocol (IP) Address.

Textbook Analysis

Analysis of textbooks that do aim to see whether the contents of the book are in accordance with competency in the syllabus . Textbooks analyzed are textbooks that have been used in the course of computer network systems , namely Data and Computer Communication 6th Authorship William Stalling.

Based on the analysis that has been done shows that the student is difficult to understand the book because the book speak English so students have difficulty understanding the text book.

Literature analysis

Event analyze literature is an activity undertaken to collect material related to the design of the modul. Structural characteristics of a module is important in the design.

Analysis of Student Characteristics

According to Kemp (1994 : 61) at the beginning of the planning is very important to pay attention to the characteristics , skills and experience of the students either on a group or individual . In order for modules developed according to the needs of students , researchers studied the characteristics of students to make observations.

Based on observations and data collection has been done , it is known that Bung Hatta University students Study Program Informatics and Computer Engineering has the background of the high school is different. Based on Table 7 in mind that the academic year 2013/2014 the percentage of high school students from majoring in science is as much as

61% and as much as 2% IPS . MAN dai students from majoring in science is as much as 32% and as much as 2%, while the IPS students from SMK is as much as 3% . The background of the high school students of the course will affect the initial ability , learning and motivation of students in the lecture Computer Network Systems . Textbooks used has not been able to become a learning resource that facilitates students with a background in high school different .

Based on the observations that have been made in the lecture during this time , it is known that outline the characteristics of student learning in the lecture Computer Network Systems are as follows .

a. Student 's easy to forget the concepts learned if students are not involved in the process of building understanding of concepts such as making discoveries . Sources used for this study were not able to involve students actively .
b. Students self-learning difficulties with learning resources are limited .
c. Students who listen and respond and can solve the problems associated with the materials and Practical given faculty are students with high academic ability .

The results of the analysis of student characteristics PTIK Bung Hatta University FKIP be behind the need for the development of a module. Module development can facilitate students to be involved in inventing the concept being studied so that what is learned is not easily forgotten . This certainly can trigger the emergence of student independence in learning.

Interview With Assiciate Partners

After analyzing the reference book of computer network systems , further activities are interviews with colleagues. Interviews with colleagues aimed to determine the problem / what obstacles encountered in the field with respect to the course of computer network systems. Interviews were conducted with Ms.Karmila Surayani, M.Kom on February 21, 2015.

Based on interviews, it is known that during this lecture Computer Network Systems only refer to a textbook and use the lecture method. Many students rely on explanations Lecturer in understanding the material. This means that the student has not been able to learn independently. Therefore, we need a practical teaching materials from lecturers with specific development methods so as to facilitate students to learn independently. Therefore, students are not too many in need of help lecturers in lectures.

b. Design

Results at the stage of defining used as a basis in the design stage . At this stage the researchers designed modules on the course Computer Network Systems . This module is designed to get students actively involved in inventing the concepts learned.

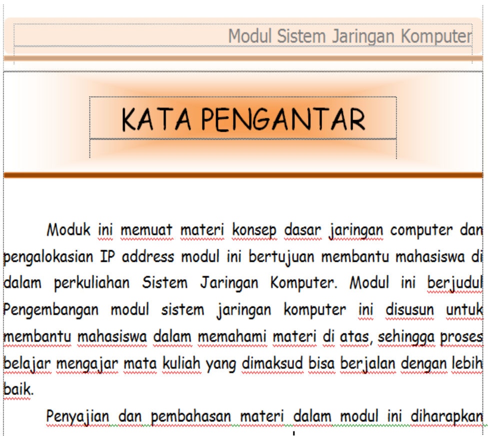
Based on the analyzes performed on the stage of definition , then designed a module for the course Computer Network Systems . Here are described the characteristics of the module are designed.

1) Cover Module

Cover is designed with an orange background that matches the color on the contents moduk. According Seta (2009) blue can provide peace and improve concentration and can provide inspiration. In the background there are several concepts cover Computer Network System written in white and gray colors and different sizes. This is done so that students have some idea about this subject by looking at the cover. The title contained on the cover is "Computer Network System Module ". This title gives the identity of the module is designed. The title on the cover using the typeface Times New Roman and Arial size 28, size 36. Here's an example of the presentation of the cover .

2) Introduction

The introduction of thanksgiving and the author's purpose of designing the module . Preface made with words that are not formal and easy to understand students. Title foreword using comics sans MS font size 22 and the words in the foreword to use the same letter with the size of 12. Here is a sample excerpt from the foreword to the modules on the course Computer Network Systems .



Modul Sistem Jaringan Komputer

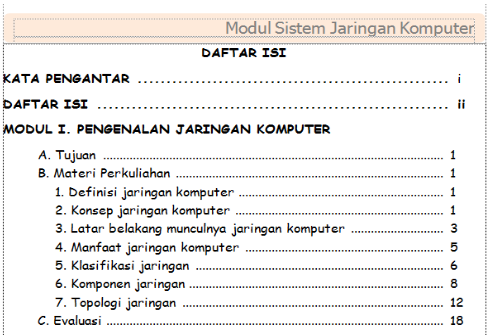
KATA PENGANTAR

Moduk ini memuat materi konsep dasar jaringan computer dan pengalokasian IP address modul ini bertujuan membantu mahasiswa di dalam perkuliahan Sistem Jaringan Komputer. Modul ini berjudul Pengembangan modul sistem jaringan komputer ini disusun untuk membantu mahasiswa dalam memahami materi di atas, sehingga proses belajar mengajar mata kuliah yang dimaksud bisa berjalan dengan lebih baik.

Penyajian dan pembahasan materi dalam modul ini diharapkan

3) Table of Contents

Contents made clear that students easily find the position / page of the desired material. Said content using comics sans MS font size 22 and typing of content use the same letter to size 12. Here's a sample table of contents on the module on the course Computer Network Systems.



Modul Sistem Jaringan Komputer

DAFTAR ISI

4) Material

The material on this module was developed with the purpose of learning so that students better understand the intent of the material that will be discussed . Here are excerpts of the learning objectives are given to students.

MODUL SISTEM JARINGAN KOMPUTER

1

Pengenalan Jaringan Komputer

A. Tujuan

Adapun tujuan setelah mahasiswa mengikuti pelajaran ini yaitu :

1. Mengerti dan memahami konsep dasar jaringan
2. Mengerti dan memahami manfaat jaringan
3. Mengerti dan memahami klasifikasi jaringan
4. Mengerti dan memahami komponen jaringan

B. Materi Perkuliahan

1. Definisi Jaringan Komputer

5) Questions Example

In the example of questions about the questions that are relevant to the material presented . Example question presented using a language that is easily understood by the form of multiple choice so as to facilitate students to learn independently . Here are excerpts from the presentation of the sample questions contained in the module.

C. Evaluasi

I. Pilihlah satu jawaban yang paling benar!

1. Yang bukan merupakan tujuan dari dibangunnya sebuah jaringan komputer adalah :
   a. Mempermudah distribusi data
   b. Memepercepat pengiriman informasi
   c. Menghambat sirkulasi data
   d. Penggunan perangkat keras secara bersamaan
2. Jaringan intranet biasanya digunakan untuk....
   a. Menghubungkan ke internet
   b. Menghubungkan orang – orang dalam perusahaan tanpa hubungan dengan luar perusahaan
   c. Menyebarkan informasi perusahaan ke masyarakat umum
   d. Tidak ada jawaban yang benar
3. Mengapa jaringan intranet dibangun dalam perusahaan? Kecuali...
   a. Untuk mempermudah perusahaan dalam distribusi data hanya dalam lingkup interen perusahaan
   b. Menjaga kerahasiaan informasi perusahaan
   c. Menambah besarnya dana untuk pembangunan jaringan intranet
   d. Memepercepat sampainya informasi ke bagaian lain dalam satu perusahaan.

6) Reference

Reference is at the end of the module . Reference contains references used at the time of writing modules . Reference useful to tell the students where the source module is Obtained . Here's one excerpt from the reference contained in the module.

MODUL SISTEM JARINGAN KOMPUTER

Referensi

Ono W. Purbo, 1999. "*Buku Pintar TCP/ IP, Standart, Design dan Implementasi*". Jakarta: Elekmedia Komputindo

William Stalling, 2000. "*Data dan Computer Communication 6th*". Prentice Hall

Douglas Comer, 1998. "*Networking with TCP/ IP, Principles, Protokols, and Architecture*". Prentice Hall

Joko Irawan, Adisuryo Wardono. 2006. "*Meningkatkan Kemampuan Jaringan dengan PC Cloning System*", Jakarta: Elekmedia Komputindo

c. Development (develop)

Effectiveness phase

At the time of evaluation in the field, the author tests the students PTIK FKIP Bung Hatta University semester 5 by the number of students as many as 29 people. This is done to see if the product of the learning modules are designed to be used in the learning process has a high level of effectiveness . Activities undertaken at the beginning of the trial of the class is learning module lecturer to explain the instructions to the class. Of course, students have prepared a tool - stationery and modules. After completing the learning process activities with learning modules authors conducted tests to see the level of effectiveness. The test results obtained are students who get very good value as much as 42 % , students with good grades 48 % and students with fairly good value of 10 %.

Conclusion

Modules for lectures Computer Network Systems is a material Students' Study Program Informatics and Computer Engineering University of Bung Hatta FKIP that can be used for tuition one semester . The module consists of four parts: Module 1 Introduction to the subject of computer networks , Module 2 on the subject of computer network operating systems , modules Protocol 3 to the subject of computer networks and Module 4 on the subject of Internet protocol (IP) address.

The module was developed through a defining phase (define) , stage design (design) and stage of development (develop). Based on the research results , obtained the following conclusions.

1. Learning Module on the course Computer Network Systems has a very valid validity of both aspects of the material , presentation , language and legibility.
2. Based on the assessment through implementation of lectures pratikalitas test known that learning modules on the course computer network system is already practical and easy to use by students.
3. The lecture learning module on the computer network system is effective based on the results of student learning.

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The Development of the Learning Devices Based on Problem Based Learning (PBL)at Class x of Senior High School

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Abstract

The problem solving ability is one of the essential abilities of students. Who do not achieve the maximum score yet. One of the factors which cause the low ability is the availablelity of learning devices could not facilitate the students yet in explore the students' ability best. As the result, the students have difficulties in finding the concept, and solve the mathematies problems particularly the problems related to their daily live. Therefore, one of the learning devices that support the objective is Problem Based Learning (PBL) model. The purpose of this research is to produce mathematics learning devices of senior high school based on PBL with the criteria of validity, practically, and affectively. The type of this research is development reaserch (Research and Development / R&D). Development that was used in this research is Plomp model that consist of preliminary research, development or prototyping phase and assessment phase. In the preliminary research, researcher carried out a needs analysis, analysis of students, curriculum analysis, and analysis concept. On development or prototyping phase, researcher design lesson plans berupa RPP and LKPD. The learning instruments validated by three mathematics education experts, an Indonesian language expert, and an education technology expert. Practicality was seen through the results of the observation sheets on the using RPP, interviews and questionnaire responses of teacher and students. The effectivenees can be seen from the result of the observation analysis of the learning process and the result of the student's learning process.

Keywords:problem based learning model, development, problem solving ability

INTRODUCTION

Mathematics is the subject have an important role in an interdisciplinary other.Studies math can train means thinking school tuition and can develop the ability of the solution of a problem, as well as by means of the concepts and principles of mathematics can be help school tuition to assess something in a logical manner, creative and systematic. Hence, mathematics given to school tuition at each level a unit of education, ranging from primary school until to college .Considering the importance of the role of mathematics, resulting in maths both one of the subjects obliged in a unit of education.For that, the government has made various effort to improve the quality of education and learning system math, of them increase the quality of teachers, furnish education facility and infrastructure and the improvement of the curriculum. But, the effort is has not yet reached maximum results.

Based on observation and the interviews conducted in several schools in KabupatenDharmasraya, revealed some farctor that causes the low score learning about mathematics school tuition at them: 1) the process of learning mathematics still abstracting nature namely without associate mathematical problems with dailylife so that school tuition did not know usefulness after they learned about the material.2) motivation learning about mathematics school tuition still weak that led to the school tuition less active in learning.3) the ability of the solution of a problem school tuition is still low , let alone that deals with a word problem.4) the learning process is still dominated by the teacher.

Based on the problems on, one learning model that can help students to improve the ability to think and solve problems are based learning problem.Based learning (the problem based learning) is one of innovative learning model that can give conditions to learn active students. Model of learning asserts in the provision of problems in early matter learning [1], with the this issue, students will know the benefits of matter what.So students not just records and but memorization matter, the students get involved reflect and may ultimately make inferences.Based learning about having characteristics where learn begins with a problem, given problem relating to the real world students, organizing learning about problems, the great responsibility to students in running learning, using small group, demanding students to present hers into the product or performance meteka learned [2].

Components in the problem based learning: the students orientation problem, organize students to learn, guiding individuals and the investigation, develop and presenting masterpiece, analyze and evaluate the problem solving [3].Based in learning problems (the problem based learning), students learn conseps mathematics associated with daily life.This will give impact very strong against character, attitude, and thinking and ability to students in response to and solve problems faced in the daily life.

To implement the approach contextual in learning mathematics then required device learning.Device learning to be developed is LKPD.Because after is very possible to direct school tuition understanding the concept of mathematics through based problems.Learning this will middle school tuition in the face of trouble daily.After good in learning mathematics be given that as possible to school tuition to be able to develop creativity they in solving a problem.ThatLKPD developed can implemented with more practical and effective, then the researcher also developed RPP containing a series of learning activities based PBL.Researchers choose development RPP because RPP is guidelines or guide the implementation of the learning that very much determined the act of teachers and school tuition in achieving the purpose of learning appointed.

Based on the above analysis , researchers will do research about the development of device learning of RPP and LKPD based PBL (the problem based learning) .RPP who will be arranged in research will be done is RPP refer to components in learning PBL .Formulation a problem in research this is how the process and the result of developing device learning mathematics based PBL valid , practical , and effective to improve the ability problem solving and activity school tuition class XSMA / MA to the matter dimensionality three?Based on formulation matter that has been mentioned , so the purpose to achieved in this research is to produce device learning based PBL valid , practical , and effective to improve the ability problem solving and activity school tuition class X SMA / MA to the matter dimensionality three.

RESEARCH METHODS

Research methodology the kind of research this is research of development by use the model plomp , start of phase of earlier investigation (preliminary research), phase development or the manufacture of the prototype stage (prototyping), and phase judgment (assessment stage) 4.Phase of earlier investigation (preliminary research) consisting of an analysis of needs, an analysis of the curriculum, an analysis of the concept of.The analysis needs to be carried out a way of doing observation, interviews and tests the ability of the solution of a problem.The information obtained from interviews with teachers about the learning process that lasts for this, both from the aspect of achieved whether or not certain the purpose of learning that has been defined in the curriculum, learning activities in the class, and the use of devices learning to financial statements and material that are considered to be difficult.The information obtained from school tuition poll in the form of characteristic LKPD as a size of paper desirable, a color that favored and about illustration a picture.

At the analysis curriculum done review of to curriculum ktsp the subjects a class of mathematical X high school.This analysis required to study the scope of material, the purpose of learning.This analysis of the determination of indicators of matter dimensionality three class X high school the first half the even to be developed device learning's.The decree, KD and the achievement indicators competence into consideration to determine concepts is required in learning mathematics and measuring achievement SK and KD.The results of the analysis SK and KD which is found in standard the contents of elaborated be indicators the achievement of competence.Based on the decree, KD and indicators this is later on arranged device learning mathematics based PBL to the matter dimensionality three of RPP and LKPD.

Analysis the concept is identification items will discussed in learning.Items this arranged systematically by associating a concept to the concept of other relevant so as to form a concept.This analysis aimed at to determine the content and the subject matter that can be served in LKPD based PBL.

RESULTS AND DISCUSSION

The results of the analysis and discussion needs done with the collection of information done by means of interviewing two peoples math teacher class X SMAN 1 PulauPunjung, SMAN 2 PulauPunjung.Based on interviews with math teacher and the needs of observation indicates learners in the form of learning new model .Based on the early tests of the ability of problem-solving learners obtained the conclusion that the ability of problem solving math students still not optimal.Learning based PBL chosen as intervention because according to theory can help to improve the ability of problem solving math learners.

According to the interviews also obtained conclusion that matter selected in the development of this is matter dimensionality three to this material constitutes the materials enough difficult to be understood school tuition on the subjects of in second semester in the class X.Material dimensionality three said hard enough to understood students because students will determine the concept of a state, distance and large angular in space dimensions three in the form of about a story or mathematical problems.

Other needs in implementing learning is the device learning that learning run in systematic to attain a desired goal.Device learning required of RPP and worksheets (LKPD) school tuition after who can afford to build the ability problem solving mathematics school tuition class X senior high school in matter dimensionality three, so we needed developed RPP and LKPD capable of make the most of problem solving mathematics school tuition.

At the analysis curriculum done review of to curriculum KTSP the subjects a class of mathematical X high school.This analysis required to study the scope of material, the purpose of learning.This analysis of the determination of indicators of matter dimensionality three classes X high school second semester to the development of device learning.The decree, KD and the achievement indicators competence into consideration to determine concepts is required in learning mathematics and measuring achievement SK and KD.Analysis the concept of aimed at to determine the content and the subject matter required in development device learning.

CONCLUSION

Conclusions the research is research development which aims to produce a device based learning PBL of RPP and LKPD .Research will be done in the process of development device based learning PBL students X high school class to the matter dimensionality three of RPP and LKPD been implemented model of plomp which consists of the three phases the phase earlier investigation, the development and phase assessment .In phase introduction needs to be implemented analysis, analisi students, analysis curriculum, and analysis concept as the basis of a device learning.Outcomes needs characteristic analysis of device learning that desire of device PBL based learning of RPP and LKPD. Curriculum analysis aims to adjust the relationship between the concept and see basic skills that can use PBL model .Analysis of the concept the subject matter needed in the development of indicators competence to the can be achieved .

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Developing Critical Thinking in Mathematics Elementary Education ThroughProblem Solving

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Abstract

Critical Thinking is suggested to be developed at young age. Primary school as the first formal education to children should be responsible to develop students' critical thinking. The main purpose of this study is to develop a learning instruction based on problem solving to develop critical thinking of elementary school students. However, this paper only presents the early information about developing learning instruction. The learning instruction that will be developed uses real life problem and questioning technique. Problem characteristics are (1) real-life problem; (2) it had many solutions (open-ended problem); (3) it was interdisiplinary problem (non routine and complex problem); (4) ill-stuctured (not all information is provided); (5) The problem invites discussion.Moreover, it is found that problem solving activities are strongly related with the core activity to develop critical thinking.
Key terms: primary school students, learning instruction, problem solving, critical thinking

INRODUCTION

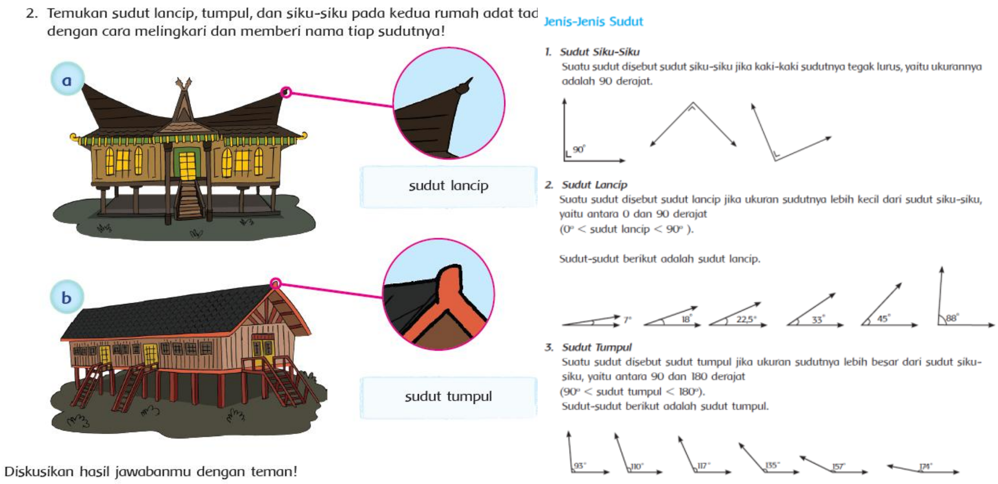
Developmen of critical thinking skills have been limelight of reseachers in the recent years (Pallinusa, 2013; Chukwuyenum, 2013;Mark, 2015; Widyatiningtyas, Kusumah, Sumarmo, andSabandar, 2015; and Firdaus, Khailani, Bakar dan Bakry, 2015). It has been reliazed that critical thinking skills become an important ability used nowadays and in far future. Critical thinking skills is needed in solving problem and encountering challenges that becomes more complext in the mean time. The activity to understanding, formulating plans, chosing a plan, implemanting a plan, evaluating and revising the solution require criticl thinking skills and it can be used to activate an indiviual critical thinking skills.

Researches that conducted by Mark (2015)and Firdaus, Khailani, Bakar dan Bakry(2015) sugessted that problem solving activities can be used in activating and developing students critical thinking. Facing various problems in term of contexts, difficulties and and complexities will provide student with unusual situations that requiere an vaious ideas. These kinds of situation are believe to efective in developing students critical thinking skills.

Citical thinking skills can be categorized as habitual thinking or the way how an individual processing an information. Eventhough it requires a toll of challenging efforts, there is posibility to develop the skill. Therefore, students should be involved in activities that trigger th development of critical thinking. It will be better if it is given since in early age.

Looking back to Indonesia curriculum, one of the goal of implementing 2013-curriculum (K13) is promoting critical thinking skills to the student. It can be seen from student activities which are observing, questioning, collecting information, assosiating/processing information, evaluating, concluding and commucating . Critical thinking is necessity in every steps of these processes. Student needs to careful and mindfull in observing the condition looking for detail that is needed. Formulating question is not an easy task since it will lead to the answer of the actual condition or problem. Each processes will have its own challenging and trickey situation. As a result, it can trigger student critical thinking.

The implementation of the curriculum is not as ideal as the concepts. This condition caused by limitation of teacher knowledge and practices. Teacher tendencies in using textbooks as primary resouches in developing learning instruction agravate actual condition of 2013-curriculum implemention. This situation also found in mathematics teaching and learning in primary school. Although textbooks already developed by using actual context, the context only used in introduction. The next activities are presenting students with abstract concepts that should be remembered. It can be shown the picture below:



Source: Indahnyakebersamaanbukutematikterpadukurikulum 2013 bukusiswa SD/MI kelas IV.

The tradisional house picture are only used to provide the existence of angle in real world. As the learning continiu, the topic about the traditional houses do not discussed anymore. It is focused in presenting the type of angles. Students are forced to remember each type of angles and its characteristics.

Realizing from this conditions, the paper will discuss the posibility to design leaning intruction based on problem solving to develop students criticl thingkin in primary school. The discussion will be focused in critical thinking, problem solving, question techniques and the posible to transforms a problem solving activity to learning instructions in effort to activae and develop critical thinking skills.

I. CRITICAL THINKING

Wood (2012) Defined critical thinking as process of using reasoning in judging the facts and differentiate what is true and what is false. Critical thinking enables individual to assess and calculate situations and create reasonable conclusion. Lipmann (1987) viewed critical thinking as skillful, responsible thinking that facilitates good judgment because it relies upon criteria, is self-correcting, and is sensitive to context. It is believed that in order to accomplish a good judgment of situations or facts an individual utilized reasonable thinking and responsible thinking. Another viewed about Critical Thinking Skills are skills that enable one to analyze and synthesize information to solve problems in broad range of areas (Facione, 1990). Matin Cohen (2015) defined critical thinking as a range of skills and understanding, including an ability to play with words, a sensitivity to context, feelings and emotions and the kind of open mindedness that allows you to make creative leaps and gain insights. Developing Critical thinking requires contexts, words analizing, emotions, opend-minded and divergent thinking. Student needs to open to all kind of possibility that proposed by the offer conditions. Based on the defenition, it can be summerized that critical thinking is a range skills and understandings of facts and situations that required words playing, sensitivity of context, feeling and emotions, open-mindedness and divergent thinking to analize and synthesize a given situation and resulted reasonable conclusions.

Critical thinking occurs when students construct meaning by interpreting, analyzing, and manipulating information in response to a problem or question that requires more than a direct, one-right-answer application of previously learned knowledge (Adams and Hamm, 1994). This can be characterized by specific core thinking skills, which can be developed in the classroom through instruction and guided practice. The list of applicable skills includes, but is not limited to: focusing, information gathering, referencing, organizing, analyzing, integrating, and evaluation. Butterworth and Thaites (2013) the core activities of critical thinking are analysis (identifying the key parts of the problem dan reconstructing it in a way that fully and fairly captures its meaning), evaluation (judging how successful a solution is) and further argument (self-explanatory) how the student's opportunity to give their own response.Moreover, Maričić (2011a) views critical thinking as a complex intellectual activity which emphasizes the following skills: problem formulation, problem reformulation, evaluation, problem sensitivity. The formulation of the problemimplies: a) the student's ability to perceive the mathematical problem and to formulate it on the basis of problem situation; b) the detection of mathematical symbolism and transferring that symbolism to spoken language, spotting the connections between mathematical symbols and being critical to presentation of these connections in words; c) the search for the inherent properties of the formulation of the problem, the identification of shades in the formulation of the problem and the use of precise spoken and precise mathematical language (Maričić, 2011b). The reformulation of the problem includes: a) linguistic reformulation of a mathematical task; b) drawing conclusions based on the identification of the connections and relationships in the content of a task, explained by clear arguments; c) identifying relationships among the terms of a task and turning the cognitive way in the opposite direction. The evaluation relates to: a) evaluation of information; b) evaluation of solutions; c) evaluation of the opinions of the authorities. Sensitivity to the problemsimplies: a) assessing the reality of the situation in the problem and the resulting solution, and taking into account the circumstances in which the assignment was given; b) identification and detection of hidden and implicit information in the formulation, abstaining from fast conclusions, sensitivity to the detection of the way of problem solving; c) the ability to identify inconsistencies and contradictions in the problem formulation and problem requirements, identification of the redundant and incomplete resulting data arising fromthe reality of a given situation and discover the pitfalls in the formulation of the problem.

Moreover, Facione (2011) formulated the core activity of Critical thinking is described as follows:

1. Interpretation is an activity to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria.
2. Analysis uses to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions.
3. Evaluation is activity to assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended

inferential relationships among statements, descriptions, questions or other forms of representation.
4. Inference usesto identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to deduce the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.
5. Explanation is being able to present in a cogent and coherent way the results of one's reasoning.
6. Self-regulation is self-consciously to monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis, and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results.

Based on the theories, it can be concluded that critical thinking core activities are problem understanding, analysis, evaluation, conclusion and communication.

II. PROBLEM SOLVING

Polya (1957) defined problem solving as a way to find a solution of a problem, so that a clear answer is established. A problem solver is encouraged to find a way or a structure such that the way or the structure can be used to find goals or solutions of the problem. Organization for Economic Co-operation and Development (OECD) (2003) viewed "problem solving as an individual capacity to use cognitive processes to confront and to resolve cross-disciplinary situations where the solution path is not immediately obvious and where the literacy domains or curricular areas that might be applicable are not within a single domain of mathematics, science or reading". Meanwhile The National Council of Teachers of Mathematics (NCTM) (2000) considers problem solving as a process of applying previously acquired knowledge to new and unfamiliar (or unforeseen) situations. Despite of the definition that have been proposed, Newmann (1990) viewed in the way when a problem solving is needed. It is needed when an individual encounter a question or a problem to be solved cannot be done through routine application/procedure of previously acquired knowledge. But it can be solved only when expanded use of mind occurred that a person must interpret, analyze or manipulate information. Based on the definitions, problem solving can be defined as an individual capacity to use cognitive processes to solve question or problem that cannot be solved by routine procedure of previously acquired knowledge.

Polya (1957) described that problem solving activities involve four main activities, namely, understanding the problem, revising plans, implementing plan, and evaluation. Understanding problem are the ctivity to know what is known?, what is unknown?, what are the data? What is the condition? Is it posible to satisfy the condition, and is the condition sufficient to determin the unknown?. Devising plan is an activity when the student using the information and their prior knowledge to formalate several posible ways to find the solution. Carrying out the plan or implementing the plan is activity to chose the possibles solution, check it spep by step and profeing the usefulness of the formulated plan. And Looking back or evaluation is step wher the prolem solver confirm the correctness of obtained solution and the efficienty and efectiveness of the choosen plan.

III. CRITICAL THINKING AND PROBLEM SOLVING

Research related to critical thinking and problem solving has been done by many researchers. The research is the use of problem solving in assesing and devloping critical thinking skills. Mark (2015), Pallinusa (2013) and Ku (2009) utilized mathematics problem in assesing critical thinking. Moreover, Ku (009) sugessted that open-ended problems are more effective in assessing students critical thinking.

Firdaus and Bakrie (2015) found that found Problem based leaning can be used to enhance students critical thinking in mathematics in identification and interpretation of information, information analysis, and evaluation of evidence and argument. Widyatiningtyas, Kusumah, Sumarmo, Sabandar (2015) also found that Problem based approach has significant in improving students mathematics critical thinking. It is also found that students' prior knowledge is strongly related with students vritical thinking ability. Based on these findings, it can be concluded that mathematics problem solving can use in both assessing and developing students critical thinking. However, the problem that can be usen in enhancing students critical thinking must fullfiled several criteria.

Stenberg (2001) believed that using real-life issues in problem solving teaching instructions will develop students critical thinking. Real-life issues are complext, involving multi-disciplinary knowledge, contextual problem, and full of suprising elements. It also provides the students wit many posible solution. Based on the problems that are used by Mark (2015), the problem should fullfilled four characteristics. The characteristics is (1); it had many solutions; (2) it was interdisiplinary problem; (3) ill-stuctured (not all information is provided); (4) The problem invites discussion.

In term of model that is used to develop students critical thingking, Staib (2003) found that student real-life role-play, the use of case studies, group discussion and student-instructor interaction are among the most effective means of developing critical thinking skills. Real life role playing will place student in actual condition and actual problem. Halpen (1998) explained the instructional program that can be used in developing student critical thinking in more detail. The istructional program is (a) a dispositional or attitudinal component thatconsisted of modeling critical thinking and actively encouraging thoughtful responding; (b) instruction in and practice withcritical thinking skills; (c) structure training activities designed to facilitate transfer across contexts, which was accomplishedby deliberately notinghowspecific thinking skills apply with very different topics; and (d) ametacognitive component, whichincluded having students discuss the process of thinking.

By analizing the core activity of critical thinking, the activity of problem solving that formulated by Polya and isntructional program that formulated by Halpen (1998), it is shown that both of critical thinking activities and problem solving activities are strongly interelated one and another. The relationships of both activities is described as follows:

1. Understanding the problem
   Problem fromulation and reformulations are parts of understanding problem. Students are considered understand the problem if the can reformulate the problem by using their own words. They know what is known what is missing, and what needs to be found.
2. Revising plans
   Formulating ideas to solve the given problem require a thorough analysis of the problem. Coming up with more than one possible solutions are the result of looking the problem in different perspectives and open-minded to all posible solution. These activities also activate student critical thinking.

3. Implementing plan
   The activity to chose a one posible way among ways that already formulated that is expected to solve the problem comes with its own difficulties. This activity involves critically reflection in problem and prior knowledge that student has.

4. Looking back/ evalution
   Evaluating, concluding and communiting process in critical thingking core activity is part of evaluation activity in problem solving. After a thorough evaluation, a problem solver will reach a conclusion and can explain it with reasonable proofs, theories and logics.

Meanwhile, the characteristics of problem that can be used in designing problem based instructions to develop students critical thinking are (1) real-life problem; (2) it had many solutions (open-ended problem); (3) it was interdisiplinary problem (non routine and complex); (4) ill-stuctured (not all information is provided); (5) The problem invites discussion.

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Design Research in Mathematics Education: A Learning Trajectory on Fraction Topics at Elementary School

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Abstract

A preliminary study on learning trajectory of fraction topics at Elementary School Padangsidimpuan reveals that the instructional process used by teachers has not facilitated the student to construct their own meaning. The effectiveness of learning in fraction topics was low and process was conventional. The purpose of this research were (1) to develop a learning trajectory on fraction topics by using Realistic Mathematics Education approach at Elementary School. (2) determine the validity, practicality, and the effectiveness of the learning trajectory. The research was conducted on fraction topic by combining model suggested by Plomp (2013) for designing the research (design research) which consist of three phases: Preliminary, Prototyping Phase and Assessment Phase and Gravemeijer & Cobb model (2006) for developing the learning trajectory which consist of three phases: Preparing for Experiment, Conducting the Experiment and Retrospective Analysis. Combination of the two models resulted a new more reliable design research model which consist of three research phases: Front-End Analysis, Prototyping Phase and Assessment Phase. For taking the learning trajectory into classroom practice, the researcher designed communicating Teacher's Guide Book and Student's Book and then addressed Validity, Practicality and Effectiveness Analysis on them by facing them to the designed learning trajectory. In the research process, quantitative data were collected through testing and presenting questionnaires, and qualitative data were obtained through observation, interview and field notes. In the next turn, through data analysis, the research resulted the final model of learning trajectory in fraction topics. The result of this research were (1) a learning trajectory on fraction topics in form of Teachers Guide Book and Student' Book. (2) learning trajectory, Teachers Guide Book and the Students' Book were considered valid, practical and effective after being judged by experts in Mathematics Educators, Language Educators, Experienced Teachers and an Educationist. Based on the research results, it can be concluded that the learning trajectory on Fraction Topics by using Realistic Mathematics Education Approach can be effectively used to improve the learning effectiveness on Fraction Topics at Elementary School. This research suggests for further similar study for different school levels to development learning trajectory on other topics by using RME Approach and determine the effect on the students' learning.

INTRODUCTION

Fraction includes basic concept and it is prerequisite of subject to study and understand about kinds of numeral, like as real numeral and complex numeral. Clark, et.al (2007) said that fraction subject fraction subject matter is need by student to develop algebra reasoning ability for next grade and to develop solving problem ability, specially for algebra and probability.

In the high of necessary of fraction mastery, it should have benefit for the students. Mark (1998) declares that fraction concept is more difficult than integer. In the right order, NAEP test result also asserts that the students in six until eight grade are weak in fraction concept (Wearne & Kouba, 2000).

In Indonesia, most of research result asserts that the student's learning score of fraction topic still low; they are: 1) Soedjadi's research et.al. said that fraction is one of difficult topic for elementary students. The difficulty of fraction is operational application and write fraction which catched with representation of totality / unity and collection of things, and 2) Depdikbud RI report shows that most of one grade students of junior high school in East Java, Middle Borneo, South Celebes (in September and October 2006) who give correct answer is 53,3 %.

Based on the preliminary research result which was done in some elementary schools in Padangsidimpuan that found one of factor as source of problem which influences learning quality, especially for fraction is curriculum factor. From learning trajectory includes hat it has been not appropriate yet. In three, four and five grade of elementary school. Fraction topic always taught, but it includes separation of subject matter which less appropriate is.

There has been researches exploring learning trajectory. Stephan & Cobb (2013) has conducted classroom based design research. This research resulted a learning theory for topic addition and subtraction of integer which can be used as guidance for teachers. Kwon, et. Al. (2013) also has conducted educational design research in Seoul, Korea on the basis of Realistic Mathematic Education Theory. This research resulted a lesson design with positive contribution to the VIII grade students ability in mathematics.

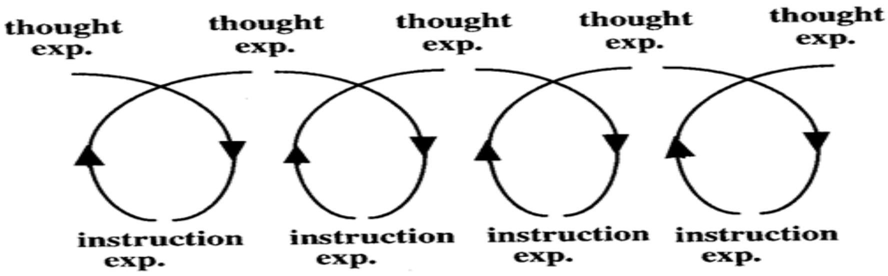
From a number of action researches, it can be concluded that: 1) educational design research can develop and resulted learning trajectory for fraction topics, 2) instruction using realistic mathematic approach can give opportunity to develop students' ability in mathematics. As logical consequence from the above researches, there still gaps needed to be explored in the latter time through researches to enrich and develop the science of mathematics education, especially in the field of learning trajectory of topics in mathematics. Accordingly, it is necessary to design learning trajectory in topic addition and subtraction by using Realistic Mathematic Education approach.

RESEARCH METHODOLOGY

The kind of this research is design research. Design research is two forms of design research, they are Plomp's design research version (2013) and Gravemeijer and Cobb's design research version (2006). The combination of Plomp's version and Gravemeijer's version are done in research phases. The developing of learning trajectory, the design use Gravemeijer's version, the combination is done in order to get good product in learning trajectory. Plomp's version is used as general developing model and Gravemeijer's version is used as equipment, all at once it is as aid in learning trajectory invitation process.

The important one in design research that there is the natural cycle involves design analysis, developing, implementation, evaluation and reflection and use formative evaluation as main activity to get quality of product. Related with this case, Nieveen (1997) and Van den Akker (1999) mentioned there are three main steps or phrases in design research (see also Plomp, 2013); they are front-end analysis/preliminary research, prototyping step and assessment step consist of sumative evaluation of the last product.

Gravemeijer and Cobb (2006) said that in combination research approach directs to develop learning trajectory in mathematics subject. It is done by thought experiment, think about the route/course of learning which are going to be faced by the students. By doing reflection of teaching training are going to be in circuit. This situation directs to description of developing that can be seen as cumulative cyclical/process, like as the picture 1 shows below:



Picture1. Relation between reflection theory and experiment (Gravemeijer& Cobb, 2003)

In this developing of learning trajectory, there are two design research combination models which used; they are Plomp's design research version (2013) and Gravemeijer and Cobb's design research version (2006) hitch done at the same time. This design research has three steps or phases; they are 1) Preliminary research, 2) Development or prototyping phase and 3) Assessment phase.

This research is done at Elementary School in Padangsidimpuan at 2013/2014 academic year; it consists of the high level (SD IT Bunayya Padangsidimpuan), the medium level (SD Teladan Padangsidimpuan) and the low level (SD Batunadua Padangsidimpuan). The technique is used to decide the subject of research is randam sampling.

FINDING AND DISCUSSION

The trajectory of addition topic and fraction subtraction are as product which developed in this research. The learning trajectory is produced that has learning order which begun fraction introduction, read and write fraction symbol, serve fraction value, same value fraction, simplify faction, compare and put fraction in the right order, fraction addition and same denominator and different denominator and fraction milt by same denominator and different denominator. This learning trajectory can be increased by students in learning activity and make easy for teacher in teaching because it is arranged ell and regularly. Learning trajectory can be seen in chart 1 below.

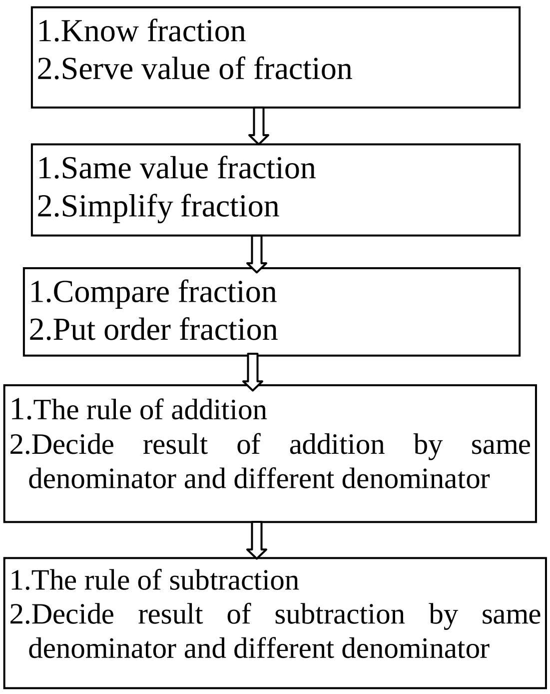


Chart 1. Learning trajectory fraction topic in elementary school

It is holded in teacher's guide book and student book. It is developed by RME principles appropriate with Van den Huivel Panhuizen's opinion (2000:5-9) that activity principle, realistic principle, stage principle, combination principle, interaction principle and guidance principle. Beside that, developing of learning trajectory points to main principle of RME hitch appropriate Gravemeijer (1994) and Freudenthal (1991) are guided reinvention and progressive mathematizing, didactical phenomenology and self developed models. This learning trajectory is developed and based on HLT; its validity has tried. The research result shows that it fulfills validity criteria, practicality, and effectiveness.

Validity

The result of validity training product shows that research product is suitable for using. Then it is tried to next research step. Some arguments support this validity training are firstly, this research finding shows that research product has fulfill basic evaluation aspect in developing product that there are logical consistency between hope product (result of expert review) and real product (result of field test). This result is appropriate with Nieveen's opinion (2013) that product designed should show there is logical consistency between hope product and real product. Hope means the product is going to be used, actual and real means the product has been able to used.

Secondly, this research of validity training also has depicted that there is using of product evaluation technique which said by Tessmer (1993), they are expert review, focus group discussion, one to one, small group and field test. According to Tessmer (1993) that the product is done by expert validator has better level than others. But, the product is validated by the expert still done a revision in FGD step, one to one, small group and field test, so that the product has stronger resistency.

Practicality

Based on explanation above, prediction and evaluation from the validator, the product is asserted be suitable to be applied in the class. Based on result of training that product are able to make students to learn mathematics gratify. It is seen from student's activities in mathematics concept finding by student interaction. It is appropriate with Vygotsky's theory that the child's intellectual developing is pushed by the interaction each other students. This finding result is strengthen and fulfill Fauzan's finding (2002), Armanto (2002), Zulkardi (2002), Hadi (2002), Saragih (2007), Arifin (2008), Musdi (2012), Kwon, et.al, (2013), Wawro, et.al, (2013), Prediger & Zuetszchler, (2013), dan Stephan & Cobb, (2013) conclude that RME approach are able to increase and develop all sorts of student's mathematics mastery.

Effectiveness

The effectiveness of product is seen from two aspects; they are student's respon to learn and student's learning result. The students are conscious to work, because the activities are designed by direct connection with daily life. This is in accordance with Treffers and Goffree's opinion (1985) that the students are going to understand mathematics concept if it is begun by contextual item and do mathematics activity horizontal and vertical.

The student's learning result is also better if it is compared with other lesson. Learning result is better after use product has been developed totality. It shows that product has been produced be effective for using; that it has high effectiveness.

CONCLUSION

Based on result research and discussion, developing of learning trajectory about addition topic and fraction subtraction by RME approach can be concluded that learning trajectory is produced which has number of learning; it is begun by fraction introduction, read and write fraction symbol, serve fraction value, same value fraction, simplify faction, compare and put fraction in the right order, fraction addition and same denominator and different denominator and fraction milt by same denominator and different denominator. This learning trajectory can be increased by students in learning activity and make easy for teacher in teaching because it is arranged ell and regularly. It is holded in teacher guidance book and student book. This learning trajectory is developed and based on HLT; its validity has tried. The research result shows that it fulfills validity criteria, practicality, and effectiveness.

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Instructional Design Using Lego in Learning Equivalent Fractions at Elementary School

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Abstract

Lego is a apart pairs gamemade of plastic, colorful, and has many different sizes which can be arranged to be various forms based on the user wish. In an instructional design, the Lego can be used as a starting point in introducing theequivalent fractions lesson to elementary school students. This research aims at producing learning trajectory on the topic of equivalent fractions by using Lego game. The research used a design research method which involving 28 students of grade IV at SDN Kertosono, Musirawas. This research design method has three phases; preliminary, experiment and representation analysis. In the preliminary phase the researcher did a review and designed a Hypotenical Learning Trajectory. In the experiment phase, the researcher did a pilot treatment to 6 students by using Lego while at the teaching experiment; the treatment was done on 26 students. The last phase, the researcher did retrospektifanalysisused to plan further activities and development activities The goal is to develop local instrucsional theory. The data was taken by using questionnaire, test and interview which was analyzed quantitatively and qualitatively.The research result shows that the students of grade IV at SDN Kertosono can understand the concept of equivalent fractions by using Lego.
Keywords: Design research, Lego, Learning Trajectory.

INTRODUCTION

Learning is a process in managing of someone's surrounding to do or show s/he particular act related with her or his needed. Learning is a process to change in their habit that starting from inability grow to ability Winkel(in Sutopo,2000:10). In teaching process at primary students need real medium because of they are in learning and playing level.

Fraction is one of mathematics' materials which learned at primary school. Fraction is one of complex concept but it very needed in teaching to the students of primary school.) (Manede, Ema,2010; Streefland, 1991). The difficulties begin from less in mastery of concept or did not understand about whole concepts of fraction. Understanding concept is first step to the next level that is an application in mathematics' count in teaching mathematic. The summation of equivalents fraction is one of teaching material that is taught at primary school, its categories in difficult to understand by students. One of mistake that often found by students is Students summing the numerator and denominator numerator with the denominator.

The result of the research fromBodrova& Leong (2005) state that children who involve active in the playing activity, they have developing of memory skill better, developing of language, able to measure their habit, and then able to adopt to the academic environment. Another important thing, playing which done by interaction to others, it is growing social competency at the children. They are able to do relationship, negotiation and solving the conflict that rise in the games (Lester &Russel, 2008). Playing provides a valuable opportunity for students in conducting activities and explores the learning of mathematics (Ginsburg, Lee & Boyd, 2008). At this research, the researcher used Lego as medium. Lego is a toy that popular in the world, caused the product which can be apart pairs and prepared in accordance with the creativity of the users without any limitation form. Lego as connectors in learning sum equivalent fractions by using research methods,. Design research is developing a series of activities using mathematics education approach realistic Indonesia (PMRI). PMRI emphasizes brought on teaching mathematics meaningful by linking it in real life. Students presented contextual issues, namely the problems relating to the situation realistically. The word realistic is a situation that can be imagined by the students or describe the situation in the real world (Zulkarnain, 2002). The goal of PMRI is increasing teaching mathematic in abstract with real life, so mathematics easy to understand (Fauzi (2002). Nuraeni (2013) state that teaching by using game will make the students interested to learn mathematic and giving understanding in using concept of mathematics at the beginner level. Based on the explanation of background of the study above, the objective of the research to create learning trajectory to help the students to find sum equivalent fractions by using lego at students of elementary grade IV

THEORITICAL REVIEW

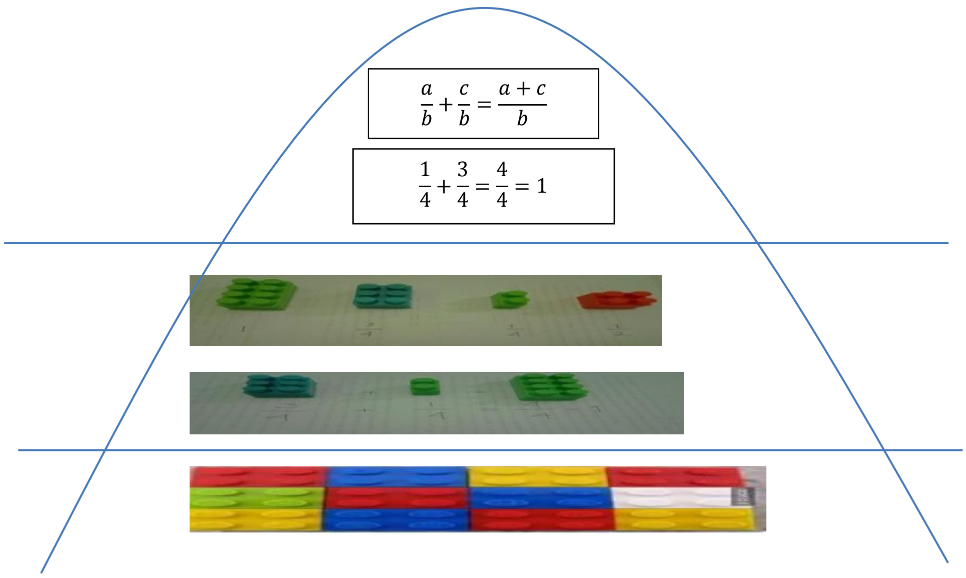
Indonesian Realistic Mathematics Education (PMRI)

Learning process especially PMRI emphasizes the learning process where the students' activity in searching, finding and building their selves the knowledge which needed become learning experiences each student. Based on De Lange,

Mathematics learning approach PMRI has several aspects as bellow, (Hadi, 2005):

1. Starting the lesson by asking a question the " real " for students in accordance with the level of experience and knowledge so that students are immediately engaged in meaningful learning
2. Problems which given should be directed in accordance with the objectives to be achieved in these subjects.
3. Students develop or create models of symbolic informally there are issues / problems presented.
4. Teaching takes place interactively: students explain and give reasons for his answer, understand his answer (other student), agreed to his friend answer, expressed disapproval, looking for an alternative settlement to another and reflect on each step that taken or the results of the lesson .

The icebergs which have been designed in this study are:



RESEARCH METHOD

In this research, the researcher used research design which is an appropriate way to answer questions of researchers and achieve the objectives of this research. In this research, designing solder sum equivalent fractions with PMRI approach in the IV grade of Primary school by using lego as the beginner in learning. In this research, there were allegations of strategy and students, thinking who are subject to change and evolve during the learning process. This research, took place cyclically (repeated) on a experiment thought to experiment teaching (Gravemeijer , 1994; embiring , Hoogland fan Dolk , 2010)

There are three steps in take research design. (Gravemeijer&Coob, 2006). The first step is preliminary design At this stage, a literature review on learning material sum equivalent fractions and scientific approach. Furthermore, researchers held discussions with teacher of math about the condition and what things are needed during the study. Then it will be designing the hypothetical learning trajectory which is a hypothesis or conjecture how the thinking and understanding of students thrive in a learning activity which in this study using a scientific approach that is specific to the material sum equivalent fractions.
According Gravemeijer (2004) HLT consists of three components namely : a. The purpose of learning mathematics for students ; b . Learning activities and contexts that are used in the learning process;, c. Conjecture process of learning how to identify the understanding and strategies for emerging and developing students when learning activities done in the class. At HLT developed a series of learning activities summation material equivalent fractions using PMRI approach contains allegations that consists of learning objectives , learning activities and allegations of students' thinking (Simon , 1995) .

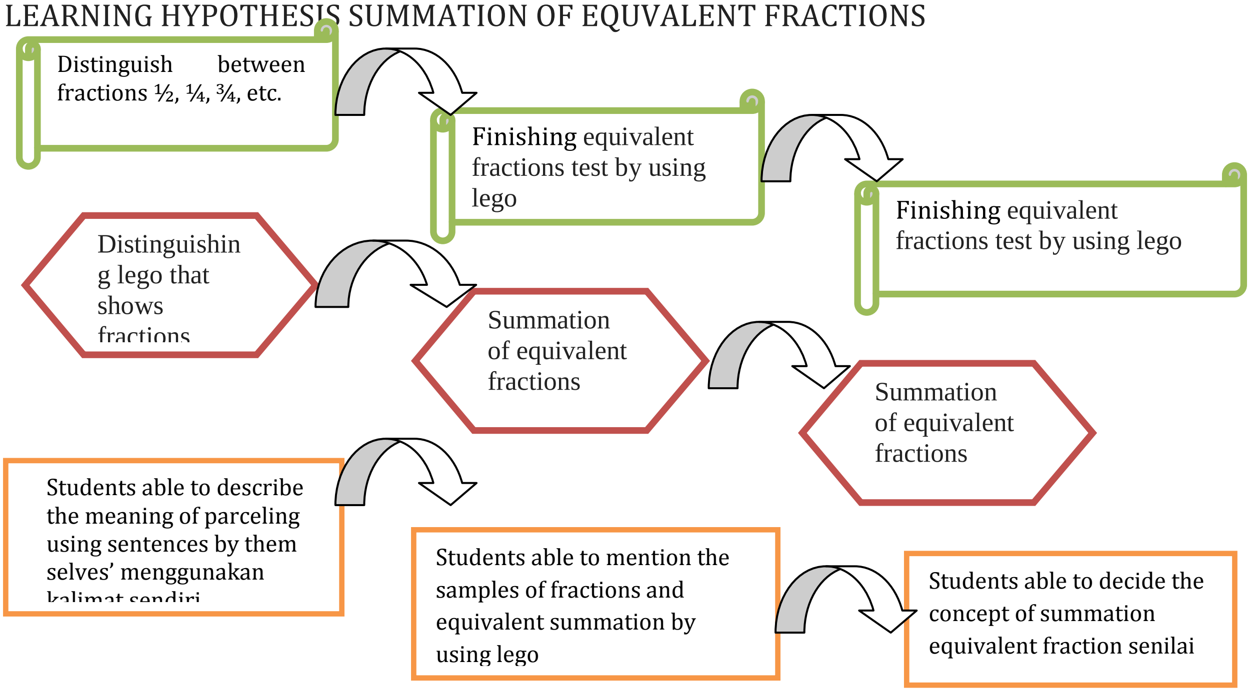
The second steps at this research are the Experiment Design that consisting of a pilot experiment and teaching Experiment. At the Pilot experiments used to try HTL that was planed. The trial at this stage, the six students who do not come from a class that will be do teaching experiment. The six students who selected they have different abilities. Experiment pilot aims to test the hypothetical learning trajectory (HLT) have appropriate initial or repeated revisions still need to be done . Furthermore, from the results of this phase, researchers will gain an overview of the condition and capabilities of students as research subjects. Teaching Experiment aims to test the design of hypothetical learning trajectory (HLT) that have been tested in pilot stage experiments and revised. At this stage hypothetical learning trajectory (HLT) is the main guidelines of what the focus of the learning process .

The third steps of the research, was Retrospective Analysis. Where is the data obtained at the stage teaching experiment analyzed and the results of the analysis are used to design the next learning activity? At this stage HLT compared with actual student learning, the results are used to answer the formulation ofproblem . This stage relies on theoretical objectives to be achieved, so the analysis conducted to determine the local data support the theory instruction (LIT) . At this stage do reconstruction and revision of local instruction theory. In doing this research, it uses the data collection techniques as video recording, student activity sheets, observation sheets, interviews, and field notes were collected and analyzed to improve HLT that has been designed. Data were analyzed retrospectively together HLT which becomes the reference.

HYPOTENICAL LEARNING TRAJECTORY

Hypothetical Learning Trajectory (HLT) is a hypothesis or perception how thinking and students' understanding are developing in an learning activity, where is in this research uses mathematic realistic Indonesia approach (PMRI). HTL is consists of three components namely: a. learning mathematics outcome for students; b. learning activity and context thatused in learning; c. conjecture learning process to know the understanding and students' strategies that come and developing whenever learning activities do in the classroom. There are HTL developing toward *preparing for the experiment:*

LEARNING HYPOTHESIS SUMMATION OF EQUVALENT FRACTIONS



The explanation of *Hypothetical Learning Trajectory* (HLT) at the picture above namely;

Activity 1:

- Students give videos about parceling of fraction, the aims to expand the students' knowledge about parceling concept. Further exploration of the parceling of fractions also use the board first fraction has been prepared by researcher.
- After pass two previous activities, students directed in order to create definition of parceling using their words and at the same time students asked to give examples of fractions. It is intended that the researchers able to determine the extent of the students' capabilities of regarding examples of fractions.
- The next activity the students were asked to do the division of fractions using a fraction board provided. In this activity students were given about the distribution of fractional complete with student activity sheet. All activities are given to students is presented in the form of student activity sheet (LKS). Furthermore, students are asked to make a conclusion.

Activity 2

After activity 1 above, Students re- awarded student activity sheet (LKS) which contains the activities of the parceling of fractions. In this activity will be seen the extent to which the student's ability to understand the concept of parceling of fractions. Some of the problems presented in the second activity are the fractional parceling problems with difficult numbers. But for students who understand the concept of parceling of fractions in activity 1 and is able to do without using fraction parceling board.

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INSTRUCTIONAL DESIGN OF SQUARE AND RECTANGLE MATERIALS BY USING TRADITIONAL GAME MEDIA "ENGKLEK"

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Abstract

This article aims to design instructional mathematics to elementary school children for the third grade in square and rectangle material using traditional media game "engklek". "Engklek" is a traditional game for children who performed in the field has been given a plane in which the line of a checkerboard pattern. The kids hopped from one box to the next box. This game is usually done in the yard of the school, home, garden, or in an empty lot. Before implementing the learning the teachers give the instruction in learning the necessary requirements to students, for example: the ropes, rulers, chalk and others. In this study, mathematics instructional is designed to use traditional media game "engklek" in square and rectangular. The results of the design study of mathematics at the material square and rectangle by using media the traditional game of "engklek", is expected to help students to: (1) find themselves depending on square and rectangle, (2) draw a square and a rectangle, (3) find ways calculate the area of square and rectangle, (4) find a way of calculating the circumference of square and rectangle, and (5) estimate the area and perimeter of the square and rectangle by counting squares on the traditional media game "engklek."
Keywords: Design, material square and rectangle, media traditional games, engklek

INTRODUCTION

Instructional mathematics has been progressing with the development of learning theory, technology and the demands of social life. Such as fundamentalchanges in resulting paradigm shift in understanding how students learn mathematics. Learning theories of Piaget and other developmental psychologists in how best directing students learn mathematics (Van De Walle, 2007).Learning is no longer seen as the process of receiving information to be stored in the memory of the students gained through practice repetition and reinforcement. However, students learn to approach each new problem with the knowledge they already had, assimilated new information, and build their own understanding. Professional teachers should be able to design learning mathematics with variations (Ekawati& Lin, 2014).

Media is a tool that has the function to convey a message (Heinich, et.al, 1996). Miarso (2009) states that the learning media is everything used to distribute messages and can stimulate the mind, feelings, concerns, and volition so as to encourage the process of learning a deliberate, purposeful control.

Instructional media is one component of learning has an important role in the learning process. Instructional media can be interpreted as a message carrier technology that can be used for learning purposes (Rusman, 2012; Smaldino, et.al, 2001). Teachers need to learn how to set a medium of learning in order to streamline the achievement of instructional objectives in the learning process. In fact, instructional media still often overlooked used in the learning process for various reasons, among others: searching for the right media, the limited time to make preparations, hard, unavailability costs, and others. It is unnecessary if all teachers have knowledge and skills about instructional media. So the role of the teacher is very influential both in use, exploit, and media selection.

Lots of traditional games media are used by the children encounter everyday life, for example: snake-ladders, engklek, hide and vituperation, galasin, serpents and others. Each medium has a character of its own and ordinance games. Traditional game of children is a media that comes from the tradition and culture that existed long ago. The traditional game media contains values that are very useful in social life. This is because, the traditional game media containing the value of teamwork, honesty, sportsmanship, and leadership.

To use traditional game makes students more familiar with the culture and national character of education. In addition, students can also learn while playing and play while learning. As an educator, she or he will be able to explore the potential of traditional children's games as a learning process. Several studies using the media traditional games children as a medium of learning in mathematics has been done by Fadli (2015), Maharani and Mahmud (2012), Widodo (2014), Yulia, &Ikfan, (2011), Sayekti (2015), and Tarmizi, Nasrun&Utami (2014).

"Engklek" is traditional games of the children which played on a flat surface that has given the line a checkerboard pattern. The game is commonly practiced in the school yard, the house, the garden, or in an empty lot. How to play hopscotch is quite simple, the player jumps on one leg in each box that has been described previously in the ground. Each player must have "oncak" (in the form of broken tiles or flat stones). "Oncak" thrown into one plot is reflected on the ground, plot with "oncak" which is already above it should not be trampled by every player, so the player should jump to the next plot with one leg around the plots that exist.

In the process of learning by using traditional media game "engklek" can be used as a medium of learning. Traditional media game "engklek" indirectly helpful in developing a character education for children, including: (1) sports, games hopscotch require to jump around so as to improve the physical ability to be strong; (2) if the taste, teach togetherness and socializing with others; (3) if careful, obey the rules of the game that have been agreed; and (4) if the thought, logic and creativity to develop intelligence (Fadli, 2015).

According to the research has been done before using the media the traditional game of "engklek", namely: Lutfi&Fitria (2012), Yulianti (2012), Roshayanti, Hayat, and Artharina (2014), Pebryawan, (2105), Febriani (2015), and Lucyana and Christiana (2014). Based on previous research, no one has designed the traditional media game "engklek" to the learning of mathematics in square and rectangular material. Therefore, the researchers intend to design learning using traditional game "engklek" for square and rectangular material to the third grade’s elementary school students.

METHOD

The method of this research was usedResearch & Development (R & D) The design and development of research using various methodologies (Richey & Klein, 2007). This study did not use general population, but it was limited to design a series of instructional media. R & D is the border of qualitative and quantitative approaches, especially to bridge the gap between research and educational practices that are used to design products and new procedures, then apply the research methods for field trials, evaluate and improve our products and procedures to meet the criteria of an effective, qualified and standardized (Semiawan 2007; Borg & Gall, 2007). This study was aimed to develop something new and was expected to improve the quality of students' mathematics learning. Skills that would be developed in this learning design of square and rectangular materials for third grade's Elementary School Students by using traditional game media "engklek".

The process of learning design square and rectangular material using traditional media game "engklek", was going to develop the model of Dick & Carey (2005). Steps were being taken is divided into two, namely (1) the stage of identification, and (2) the design stage. At the stage of identification of the activities carried out were: (1) identify instructional goals, (2) conduct instructional analysis, and (3) Analyze Learners and Contexts. While the design stage conducting the activities were: (1) write performance objectives, (2) develop assessment instruments, and (3) develop instructional strategy. The stages implemented were six stages of ten stages that exist in the development model of Dick & Carey. It was tailored to the intended purpose of the study design learning square and rectangular material using traditional media game "engklek".

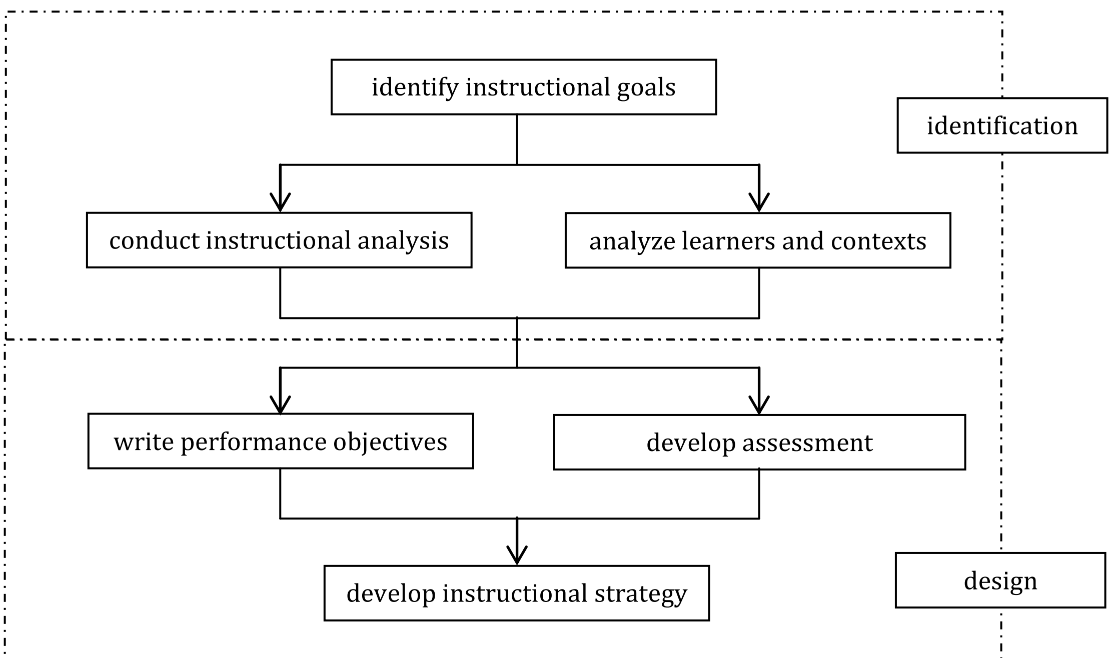

Figure 1: The Sixth Stage of the Tenth Stages of Development Models Dick & Carey

RESULT AND DISCUSSION

RESULT

The Instructional media design ofsquare and rectangular material were using traditional media game "engklek", it was divided into two stages, namely stage to identify learning and instructional design stage.

1. ***Identified Phase Intructional***

   At this stage, researchers conducted (a) identified instructional goals, (b) analyzed learners and Contexts, (c) Conducted instructional analysis. The results of this phase are as follows:

   a. Identified Instructional Goals

      Identified early stage was to determine what they want students when they have completed the learning program. Identifying learning needs was a process to: (1) determined the gap of student performance in the past, (2) identified the forms of activity most appropriate learning process, and (3) determined who the target students who can follow the learning activities.

      Results of a phase in identified learning needs by using media the traditional game of "engklek " were follows: (1) trained the imagination of students to play while learning, (2) provided the experience more real for students and evoke worlds of theory with reality, (3) knew the traditional game of "engklek" to students, and (4) after used these media students have competencies in square and rectangular material. The results of the activities were identified learning needs which was derived the type of knowledge, skills, and attitudes are still common, which is the result of learning that is expected to be mastered by students after learning.

   b. Analyzed Learners and Contexts

      Square and rectangular were the subject matter of the elementary school curriculum. This material was the earliest materials to be introduced in third grade's Elementary School students. The materials were taught in this class, in the form of (1) determined the nature and square and rectangular elements, (2) calculated the circumference of square and rectangular, and (3) calculated the outer square and rectangular

   c. Conduct Instructional Analysis

      Competencies were required in learning the material square and rectangular the third grade's Elementary School students were: (1) students found themselves in depending on square and rectangular, (2) the student were able to draw a square and a rectangle, (3) students with the guidance of teachers were discovered in how to calculate the circumference of square and rectangular, (4) students with the guidance of teachers were be able to find how to calculate the area of the square and rectangular, and (5) students with the guidance of teachers were able to assess the area and perimeter of the square and rectangular by counting squares on media traditional game "engklek".

      It was expected to use traditional media game "engklek", students were able to learn about the contextual square and rectangular material. It was suitable with research (Wijaya, 2013), which involves problems in supporting contextual learning in mathematics. In instructional design using traditional media game "engklek", students were involved directly with contextual issues such as boxes of games of the square and a rectangle.

2. Designed Phase of Learning

At this stage, researchers were conducted the research as follows: (a) wrote performance objectives, (b) developed assessment instruments, (c) developed the instructional strategies. The results of this phase were follows:

a. Wrote the Performance of Objectives

Instructional Objectives formulated in the form of a verb that has been seen (observable). Instructional Objectives was the only basis for preparing grating tests. Therefore, Instructional Objectives was containing the elements have been provided the clues in the compiler test that has been measured behavior in it.

At this stage, it was formulated in General Instructional Objectives and Specific Instructional Objectives. General Instructional Objectives and Specific Instructional Objectives were formulated by using the ABCD format (Audience, Behavior, Condition and Degree).

General Instructional Objectives: After completed the topic which was using traditional game media “engklek", students were able to draw and calculate the circumference and area of the square and rectangular.

Specific Instructional Objectives:(1) After used traditional game media "engklek", 100% of students were able to find themselves depending on square and rectangular; (2) After used traditional game media "engklek", 100% of students were able to draw a square and rectangular; (3) After used traditional media game "engklek", 80% of students were able to calculate the circumference of square and rectangular; (4) After used traditional game media "engklek", 80% of students were able to calculate the area of the square and rectangular; and (5) After used traditional media game "engklek", 80% of students were able to calculate the circumference and area of boxes in the traditional media game "engklek”.

b. Developedthe Assessment Instruments

This step was to develop a grain of assessments to measure student ability as estimated from the purpose of learning. Item ratings were intended to measure the level of each student’s mastery of the behavior listed in the competency (Specific Instructional Objectives). The expected skill wasthat students were able to answer the questions given in the traditional media game of hopscotch, illustrated cards in a matter that has been prepared. The cards matter containing questions related to Specific Instructional Objectives that have been made.

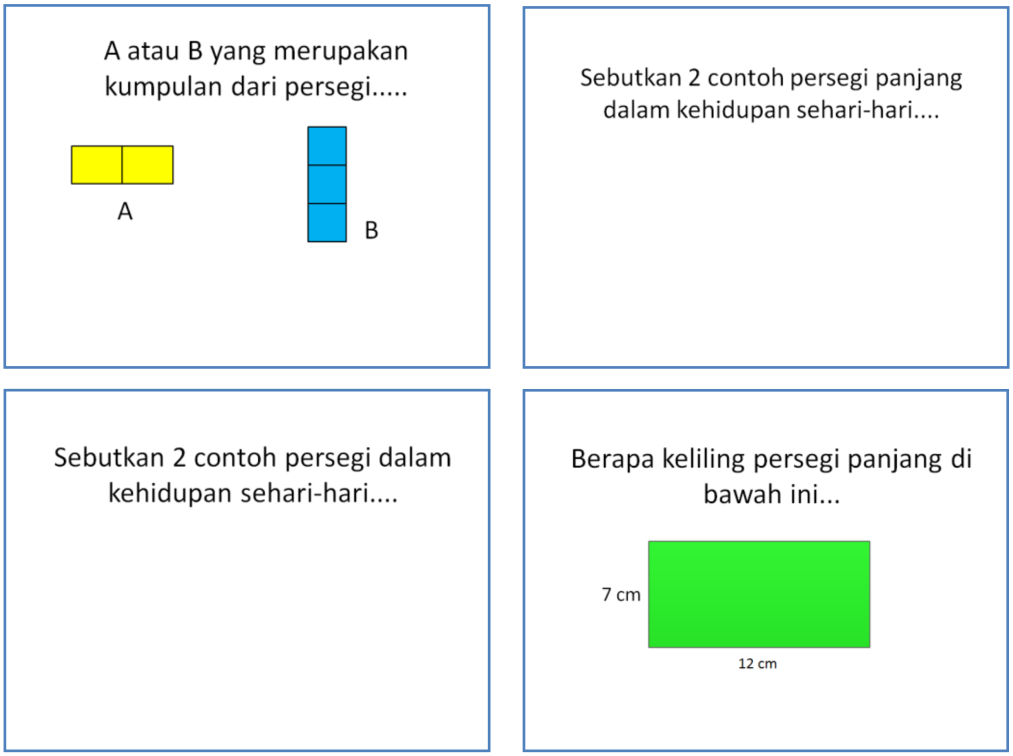

Figure 2: Example of Item Rate in Cards' Problems

c. Develop Instructional Strategy

At this stage, researchers were designing learning strategies in instructional design used traditional game media "engklek". The strategies which used were: (1) the sequence of learning activities, (2) teaching methods, (3) media, and (4) the time spent in completing each step of activity.

In this research study was designed by using traditional media game "engklek" three times a meeting of ten meetings are planned. Instructional design using the media game "hopscotch" was a distraction to learning. Therefore, the design of this study conducted alternately by learning in the classroom.

Instructional design using traditional media game "hopscotch", preferably during the second meeting. At this second meeting, teachers were applying the material square and rectangular contextually. Before implementing the learning activities using traditional media game "hopscotch", the teacher had instructed the needs required in learning to students, for example: the ropes "rapia", rulers, chalk, "oncak" and others.
Instructional design at an early stage was to introduce traditional media game "hopscotch" to students. The steps in using game media traditional "hopscotch" in the early stages, were follows: (1) the teacher devided the students into several groups, (2) in each group was required to draw the boxes as game media traditionally "engklek", (3) students determined the lengths of the sides of the boxes they made, (4) students identify which square and which many square long, (5) the teacher had given card

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questions to be answered by a group of students, and (6) the group most many respond has been declared as the winner.

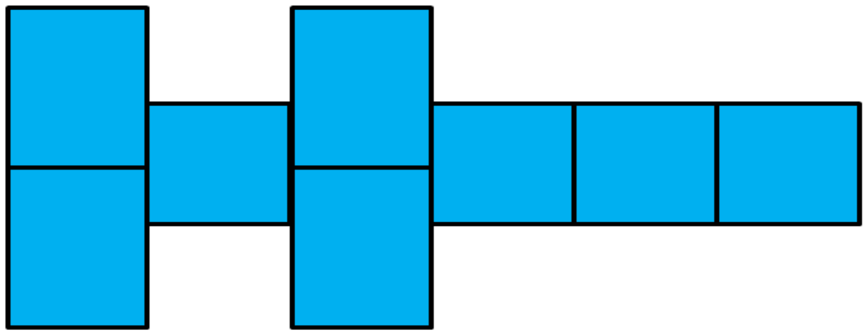

Figure 3: Media Design of Traditional Games "engklek"

Next Instructional design of traditional game media had finally leaded the students in determining the circumference and area of a square and rectangular. The steps in at this stage, werefollows: (1) the teachers had devided the students into several groups, (2) in each group was required to draw media boxes as a traditional game of "engklek", (3) the student determines the length side- side of the boxes that they make, (4) students were guided how to determine the circumference of the square, and many square length, (5) students were guided how this determines the area of the square, and many square length, (6) the teacher had given card questions to be answered by a group of students, and (6) the most likely group answered was declared the winner.

Instructional design at the final stage was to conduct a traditional game of "engklek". The steps in at this stage, as follows: (1) the teacher had prepared the cards about to be answered students on the game's traditional "engklek", (2) the teacher had explained the rules of the game, the cards matter which given to students was accepted when the students thrown "oncak" on line or out of boxes, (3) the students were divided into several groups, (4) representatives of the group playing the traditional game of "engklek", and (5) those who won this game were the group who had mostly home by the game “engklek”.

Figure 4: Students Play Traditional Games Media "Engklek"
(https://idebermainanak.wordpress.com/tag/engklek/)

Instructional design learning material of square and rectangular were using the media the traditional game of "engklek", was expected to help students: (1) found themselves in depending on square and rectangular, (2) drewa square and a rectangle, (3) found a way of calculating the square area and rectangle, (4) found a way of calculating the circumference of square and rectangular, and (5) estimated the area and perimeter of the square and rectangular by counting squares on the traditional media game "hopscotch."

DISCUSSION

This research was aimed to design learning only square and rectangular material using traditional media game "engklek". The results design of the three sessions of ten meetings on square and rectangular materials were follows:

Instructional design of the first, with the steps: (1) the teacher had divided the students into several groups, (2) in each group was required to draw the boxes as game media traditionally "engklek ", (3) the students were determined the lengths of the sides of the boxes they made, (4) students were identified where the square where many square and long, (5) the teacher had given card questions to be answered by a group of students, and (6) the most likely group answered was declared the winner. This design is to answer Specific Instructional Objectives: (1) after the use of traditional media game "engklek", with 100% of students were able to find themselves in depending on square and rectangular; and (2) after using traditional media game "engklek", with 100% of students were able to draw a square and a rectangle.

The second learning design steps were follows: (1) the teacher had devided the students into several groups, (2) in each group was required to draw the boxes as game media traditionally "hopscotch", (3) the students determine the lengths of the sides of the box -box they make, (4) students were able to guide how to determine the length of many square around the square and, (5) students were guided how this area of the square, and many square determine the length, (6) the teacher had given card questions to be answered by a group of students, and (6

) the most likely group answered was declared the winner. This design is to answer Specific Instructional Objectives: (1) after the use of traditional media game "engklek", with 80% of students can calculate the circumference of square and rectangular; (2) after using traditional media game "hopscotch", with 80% of students were able to calculate the area of the square and rectangular; and (3) after the use of traditional media game "hopscotch", with 80% of students were able to calculate the circumference and area of boxes in the traditional media game "hopscotch."

The third instructional design steps were: (1) the teacher had prepared the cards about to be answered students on the game's traditional "engklek", (2) the teacher had explained the rules of the game, the cards which has been given to students when they thrown a "oncak" on the line or out of the boxes, (3) the students were divided into several groups, (4) representatives of the groups playing traditional games "engklek", and (5) those who won the game when they finally got a "home" in traditional game “engklek". This study design was to design a phase of the evaluation for students in the mastery of the material square and rectangular. Instructional design was also the peak stage of the traditional game of "hopscotch". Indirectly this game helpful in developing a character education for children, including: (1) sports, (2) if the taste, (3) if the liver, and (d) if the thought (Fadli, 2015).

This research did not carry out due diligence phase of the experts, one to one, small group, and a field test. Expected further research could measure the effectiveness of instructional design square and rectangular material using traditional media game "engklek", by doing a formative evaluation at selected elementary schools. Expectations of this research would become a reference for teachers, lecturers, students and other researchers to explore more traditional game media in Indonesia as a learning media.

CONCLUSION

Instructional mathematics learning design of square and rectangular materials used traditional game media "engklek" was consisting of three meetings. It was conducted by using three designs which expected to help students: (1) found themselves depending on square and rectangular, (2) drawn a square and a rectangle, (3) found a way of calculating the area of a square and a rectangle, (4) found a way of calculating the circumference of the square and rectangular, and (5) estimated the area and perimeter of the square and rectangular by counting squares on the traditional media game "engklek."

This research could be continued to see the effectiveness of the use of traditional media game "engklek" for the third grade’s Elementary School Students. Steps which had been taken was to test the feasibility of the traditional media game "hopscotch" as a media of learning in square and rectangular material by conducting formative evaluation.

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Econometric Textbook Development Based Guided Discovery (Teory and Aplication By SPSS and Eviews)

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Abstract

This study aims to produce a textbook based on guided discovery valid, practical, effective for lectures econometrics. This type of research is research and development. The products that will be developed in this study is based econometric textbook guided discovery. This study uses research design development with 4-D model of development which consists of four stages which include: defining (define), design (design), development (develop), and dissemination (desseminate).This study begins with a define, which analyzes the course syllabus econometrics. Syllabus analysis performed to see if the material being taught in accordance with the expected competencies. The next activity is to analyze the reference books for the course econometrics. Analysis conducted reference book aims to see whether the contents of the book results with competence in the syllabus. At the design stage is produced textbook for lectures econometrics for one semester. This form of textbooks designed based on the characteristics of guided discovery, the students are guided perform data processing and interpretation of processed data and draw conclusions. At this stage of development, do is validate, test the practicalities and the effectiveness of textbooks and the last stage is the desseminate, using textbooks that have been validated.

Keywords: Econometrics, Textbook, Guided discovery

INTRODUCTION

The learning process is a series of multiple systems that are related to each other. If one system can not function, the system can not work optimally. The learning process will be optimized if it can use the media that are around us. The use of media in the learning process is expected to help faculty make it easier to teach the material to the students. Some of the things that caused this to happen is still the view of the lecturers that the learning media is a tool that is expensive and difficult to be made by the lecturer. One of the most media in the learning process on campus is the textbook and the textbook / learning module. Therefore the faculty in general take advantage of printed books and diktat / learning modules obtained from the issuer (not made by the lecturer) so that the resulting material is given in the textbook are less suited to the material that will be taught by lecturers.

In an effort to increase the effectiveness of the learning process, in addition to learning strategies, textbooks also play an important role. Students are beings who in the process of becoming scientists, and therefore must be planned systematic steps so that the process is going well. Textbooks become an essential component as a step toward "reading" text book contents depth level is quite difficult for students.

Learning resources are lacking to make students experiencing difficulties in lectures, for example when doing exercises. Students need a lecture material in the form of a textbook is structured in addition to textbooks. Textbook is the compilation of a guide book and a collection of practice questions that have been packaged in such a way that made gradually to train and improve the skills of students as well as improving understanding of the stages of analyzing the data.

During this time the students rely on sample questions from the textbook and an explanation from the lecturer alone when perkulihan underway. This way is certainly not optimal because pembahsan about in textbooks does not help students in constructing knowledge and the explanation given by the lecturer are limited by time. If given practice or homework only students belonging smart who do own, the rest follow the example that has been done by his friend. This indicates that the motivations and activities of students in lectures is low resulting in student results are also low. This study aims to produce a textbook for lectures econometrics (Theory and Applications with SPSS and Eviews) are valid, practical, effective.

The learning process is the essence of education in high perdosenan. Community demands for efficiency, productivity, quality effectiveness and usefulness of the results in the implementation of the learning process in high perdosenan a thing becomes imperative. However, in the implementation of lectures in class turned out to be faced with the problems that hinder the success of the learning process. Problems that occur and very troubling lecturer is the low participation of students in the process of teaching and learning activities in the classroom.

In a lecture that took place during this time, the students tend to just sit down, be quiet, and just listening without giving a response that is relevant to the course material. During the lecture took place never showed any questions or ideas associated with the lecture material. This trend is an obstacle for a lecturer for causing penguasaaan achievement of lectures by students is very low. Efforts to increase student participation in lectures is an important thing to do, because it is closely related to educational success in high perdosenan. To motivate student learning that is expected to increase participation in lectures, the study should be designed creatively, which allows the interaction and negotiations for the creation of meaning and the construction of meaning within the students and faculty, as to achieve meaningful learning. One method that can make students active in learning is a method of guided discovery. According Suryobroto (2002: 193) stated that the method of the invention is a mental process where students assimilate the principles and concepts or something. Mental processes are for example: observing, classifying, making allegations, explaining, measuring, making inferences, and so forth. According Wasriono, et al (2015: 61) product development learning device is said to be practical if the student's response and response assessment teachers have a practical category.

The learning model guided discovery is a learning model that is student oriented with the technique of trial and error, guesses, uses intuition, investigate, draw conclusions, and allows teachers conduct guidance and signpost in helping students to use ideas, concepts, and skills they have to discover new knowledge (Purnomo, 2011)

Guided Inquiry or guided discovery approach can be one alternative that can enhance students' understanding of the concept. In this approach students are actively involved to work together to find, explore, exploring, experimenting, menyelidiki of various circumstances, to locate and construct new ideas, new knowledge, based on various sources of information and prior knowledge or concept that has dominated previous, and next conclude, test its conclusion and to report on their work (SahatSaragih and ViraAfriati, 2012) Guided discovery learning model focuses on the process of learning, such as student-student interaction, student-teaching materials, and student-teacher; in addition aims to develop science inquiry activities in the domain of content. Students receive problems, and teachers provide guidance and direction on how to solve it so that students find the concept of lesson content and find ideas or new ideas are structured, organized and meaningful. In the classroom students and teachers happened controls are balanced. Thus students with more emphasis on obtaining optimal content understanding through scientific inquiry activity (Parno, 2014)

RESEARCH METHODS

This type of research is research and development (Research and Development). According Sugiyono (2012: 407) R & D (Research and Development) is a research method used to produce specific products and examine the effectiveness of the product. To be able to produce certain products that are used research needs analysis (used survey methods or qualitative) and to test the effectiveness of these products in order to function in society at large, the necessary research to test the effectiveness of these products (used an experimental method). The products that will be developed in this study is based econometric textbook guided discovery. This study uses a study design development with 4-D model of the development of the draft Thiagarajan, Semmel, and Semmel (Trianto, 2007: 65). The model development consists of four stages which include: defining (define), design (design), development(develop), and dissemination (desseminate).

RESULTS AND DISCUSSION

Activities to get this textbook begins by passing pendefenisian stage (define). At this stage, an analysis of the course syllabus econometrics. Syllabus analysis performed to see if the material being taught in accordance with the expected competencies. The material on the syllabus are in accordance with competency to be achieved by the students. The order of the material was suitable material foundations of econometrics and an introduction to the SPSS and Eviews is the first material that is the foundation that must be learned and understood by students before the next study material.

The next activity is to analyze the reference books for the course econometrics. Analysis of reference books that do aim to see whether the content of the book results with competence in the syllabus. Of the various books that were analyzed it was found that the language used by these books are highly theoretical and less communicative with the students so that sebahagaian students have difficulty understanding the book materials and material difficulties are also practicing the book with software SPSS and Eviews. Besides the material and exercises presented in the book kuran able to invite students to meaningful learning. After analyzing supporter book econometrics course, the next activity the researchers did was to discuss and conduct interviews with colleagues. From the discussion with colleagues it is concluded that the difficulties experienced by students is to understand the concept, students are less able to develop the information they obtain in the course face-to-face, logic and sitematika way of thinking students who are not able to construct knowledge, students are often unable to develop a theory, still many students who memorize the theory without understanding the meaning contained.

Based on observations of researchers in the classroom, it is known that the learning that takes place during this time is still dominated by the lecturer as an information center. Most students have not been able to develop the information obtained in the course face to face, and are more likely to rely on professors to find the concept. It was also found that students sebahagian difficulty performing data processing software SPSS and Eviews, and even interpret the processed data is also not able to.

Pursuant to the analysis of the syllabus, the syllabus reference analysis and based on discussions with colleagues can be stated that in general the students are still relying on the explanation lecturer in the classroom so desperately needed a textbook that is able to guide and construct student understanding. Therefore, this textbook will facilitate students to learn to understand the concepts of econometrics and putting it into practice with the help of software SPSS and Eviews.

At the design stage (design), textbook designed is based on guided discovery textbook for lectures econometrics. This textbook is designed for lectures econometrics prepared for a semester consisting of 15 subject matter. This form of textbooks designed based on the characteristics of guided discovery, the students are guided perform data processing and interpretation of the processed data and draw conclusions.

Characteristics textbook design results presented in detail, namely: 1) Each instructional materials have the identity of subjects. Identity of the course aims to impart information to students about the study materials that will be discussed, 2) Each instructional materials containing four achievement (learning outcomes) / competencies related KKNI, so that students and faculty as users of these materials can Understand the achievement of learning (learning outcomes) / KKNI related competencies that must be achieved by the students. 3) The teaching material contains subject matter that will be discussed on teaching materials. This material is intended that the principal users of teaching materials can know anything was discussed in the textbook. 4) teaching materials outlining the subject matter in accordance with maeri by using language that is more easily understood by mahaiswa. 5) Each teaching materials have examples of cases that must be resolved econometrics manually or SPSSand Eviews.

Learning and textbooks are the two things are mutually complementary. Learning will take place effectively if equipped with instructional media, one of which is the textbook. Textbooks can be designed and used properly pay attention to a number of principles in learning. Learning components comprising students, teachers or educators, material / materials, manner of presentation of teaching materials, and training. Good textbooks have reflected a coherent unity of all components, so that the teaching materials, manner of presentation of teaching materials, and training teaching materials can be easily understood and practiced, both by students and teachers.

According Lusiana and Andari (2015: 991) that the use of guided discovery learning models is one way to optimize understanding, activity and achievement of students. Work assignments are structured expected to encourage students to study these materials as directed.

In essence, the textbook is a medium of learning a discipline or knowledge. As the media, textbooks should contain instructional materials, manner of presentation of teaching materials, teaching materials and training models. The material is used as teaching material should be presented in a certain way, so that students have the ability with regard to understanding, skills, and feelings. As a reflection of the ability of the students will be able to solve problems, both filed in the exercises and problems in real life. Textbooks must also be able to help teachers to improve their teaching, and help them in improving the ability of students.

Textbook is the course material consisting of a series of lectures and compiled specifically, clear and interesting that includes content, sample questions, and exercises. Nasution (2008: 205) argues textbook is a complete unit that stands alone and consists of a series of learning activities designed to help students achieve a number of objectives which specifically and clearly defined. Textbooks provide the opportunity for students to learn independently, because each student will make use of different techniques to solve a problem.

It can be concluded that the textbook is the kind of book that is intended for students as the provision of basic knowledge, and used as a learning tool and used to accompany lectures. In order textbooks can be used well, students need to examine the existing sections in the textbook, from the book's title, table of contents, the titles of each chapter, the form of questions and exercises, until the end of the textbook. Brief examination of the contents of the book will generate interest and attention of the students to understand the contents of the book. The quality of textbooks depends on its usefulness for the purposes of student learning. The more purposes that can be served, the better textbooks. For example, to allow students to learn at their own pace; for deepening; to hold a revision and reflection; or to record important things for other purposes. Quality textbooks thus not only lies in the design of the book itself, but also on kebermanfaatannya. Textbook is good not just a collection of ideas, but the draft programmatic and systemic that it becomes a useful work, meaning a compact but solid.

Suherman (2003: 212) explains that in teaching methods with the method of the invention hoped that students actually learn to find their own active ingredients studied. Moreover, according to Sabri guided discovery methods (2005: 2012) is a way of delivering the topic of econometrics so that the learning allows students to find their own pattern or structure through a series of econometric past experiences that are on the guidance of educators concerned. In guided discovery learning tasks professor as a facilitator. While Hudojo (2003: 123) argues that the method of the invention is a method of delivering topics of the subject matter, so that the process of learning allows students to find their own patterns or structures subject matter through a series of learning experiences in the past. Remarks to be learned is not presented in its final form, the student is required to do mental activity before the information is learned it can be understood.

Thus it can be affirmed that the discovery method is deliberately designed to increase students' activity is greater, process-oriented, to find their own information necessary to achieve instructional goals. Thus the discovery method is process-oriented and results together. This kind of learning activities to make students actively in the learning process, the lecturer only acts as a facilitator to set the course of learning. Such learning process had a positive impact on the development of creative thinking of students.

The study's findings are supported by the results of research Estuningsih (2013:27) who found that developing a discovery-based LKS LKS-based Guided to develop guided discovery can improve learning outcomes of students. Subsequently (Parno, 2014) guided discovery model learning can improve students' achievement. Model guided discovery refers to the theory of constructivism, which requires learning as an active activity, where students build their own knowledge and find your own meanings from what they learned. Therefore, the material being studied can achieve a high level of capability and longer lasting because students are involved in the process of the invention (Numan, 2012)

CONCLUSION

The structure of the contents of textbooks based on the design load guided discovery learning goals (standards of competence) in the form of outcomes to be achieved during the lectures. Loading theories, but contains a description of the material in accordance with the competence to teach lecturers. Loading exercises guided by stuffing that is not yet complete, so students need to be guided to supplement the textbook. Loading guided practice and independent practice. Guided exercises are exercises accompanied by directives. While the independent exercise demanding independence of students in solving problems. By completing practice questions, students are expected to work and experience for themselves the knowledge. Textbook contains conclusions, is the part that is required of students in the form of lecture material conclusions of the meetings and the questions in the textbook lead students to construct knowledge

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Problems and Lesson Learned in the Implementation of Lesson Study for Learning Community (LSLC) in the Learning Process of Integral Calculus Course at theStudy Program of Mathematics Education the Department of Mathematics and Science Education the Faculty of Teacher Training and Pedagogy the University of Bengkulu

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Abstract

The purposes of this study were (1) to know what problems experienced by students in the implementation of LSLC in the learning process of integral calculus course at the Study Program of Mathematics Education; (2) to find out lesson learned in the implementation LSLC in the learning process of integral calculus courseat the Study Program of Mathematics Education.This was a qualitative descriptive research. This research study was conducted with the procedure lesson study disclosed by Masaaki (2012), namely (1) Plan; (2) Do; (3) See; (4) Re-Design.Based on the results of this study, we can conclude that in the implementation of LSLC in the learning process of integral calculus course at Study Program of Mathematics Education (1) Problems experienced by students: (a) There was still a lack of mutual learning between students in one group because learning applied during this was individual; (b) Students still had perceptions that the groups were aimed to work together in solving problems, not to learn from each other; (c) There were still students who did not want to join the groups.(2) Lesson learned: (a) LSLC activities required cooperation from all parties concerned to make it easier to invite lecturers to conduct open lessons or become an observer as well as to arrange schedules and implementation of open lessons; (b) Media was required to facilitate students to collaborate; (c) Sufficient number of recording devices was needed to carry out observations; (d) Students who did not want to join the groups needed special attentions.

Keywords : lesson study, LSLC, open lesson

A. INTRODUCTION

1. Background

Integral calculus is a compulsory course at the Study Program of Mathematics Education the Department of Mathematics and Science Education the Faculty of Teacher Training and Pedagogy the University of Bengkulu. This is a prerequisite course to take other courses, namely multivariable calculus, ordinary differential equations, and complex functions. The number of students taking this course is relatively large, ranging from about 30 to 50 students in one class so that the lecturer has difficulties to identify how interaction of students during learning processes in classrooms and what problems they are experiencing. Besides that, the lecturer should also concentrate on the lecture materials. One way to overcome these problems in order to improve the quality of learning is by implementing Lesson Study for Learning Community (LSLC). Lesson study is a valuable opportunity for educators to focus on examining students learning without worrying about managing student learning and teaching activities (Hurd& Lewis, 2011).

Educational reform focusing on competition is developed in countries implementing neo-liberal policies, but there is a critical opinion that the protection of the equality and right of teachers and student learners in teaching is needed (Saito &Atencio, 2015). LSLC is an activity to improve the quality of learning that has been developed in Japan. Since the 1990s, in Japan, lesson study activities has changed into research to improve the quality of learning activity and this activity also increased collegiality (Asai, 2015). Nevertheless, this also has objectives to improve instructional processes in classrooms. Lesson study as an action research can be implemented as a part of school lesson study (Chichibu &Kihara, 2013).

One research on lesson study has been conducted atthe Study Program of Chemistry Education the Department of Mathematics and Science Education the Faculty of Teacher Training and Pedagogy the University of Bengkulu with the title “Lesson Study in Chemistry School I Course as an Effort to Improve the Quality of Learning and Development of characters (Character Building)”. This research concluded that the application of the lesson study gave positive impacts toward the students’ learning activities in Chemistry School I Course, helped in building students’ character and students’ understanding of concepts in School Chemistry I course (Elvinawati, , Sumpono,& Amir, 2012). However, no researches on lesson study that has been done at the Study Program of Mathematics Education the Department of Mathematics and Science Education the Faculty of Teacher Training and Pedagogy the University of Bengkulu. In LSLC, children who are learning together, teachers, and parents work together to improve education (Saito, Murase, Tsukui, & Yeo, 2015). Moreover, Sato (2012) explained that educators must open their classroom at least once a year for other educators and together with other educators build relationships to educate learners as the philosophy of public in learning community. Therefore, LSLC should be developed in classrooms.

2. The Purposes of the Research and Research Quentions

This research study has three purposes, namely:

a. To know what problems experienced by students in the implementation of LSLC in the learning process of integral calculus course at the Study Program of Mathematics Education.
b. To find out lesson learned in the implementation LSLC in the learning process of integral calculus course at the Study Program of Mathematics Education.

Research questions in this research study are:

a. What are problems experienced by students in the implementation of LSLC in the learning process of integral calculus course at the Study Program of Mathematics Education?
b. What is lesson learned in the implementation LSLC in the learning process of integral calculus course at the Study Program of Mathematics Education?

B. RESEARCH METHOD

This was a qualitative descriptive research study. Studies research on instructional process and focus on students are qualitative descriptive research study (Murase, 2015).Data found in this research study are analysed descriptively.This research study was conducted based the procedure lesson study disclosed by Masaaki (2012), namely:

1. Planning (*Plan*): creating a unit of lecture program (SAP) and preparing instruments needed in instructional processes.
2. Implementing(*Do*): model lectures do instructional processes and observers do observations by making notes and recording the instructional process and students' responses.
3. Reflection (*See*): reflecting on observation results.
4. Re-Design of learning (*Re-Design*): improving instructional design based on the reflections.

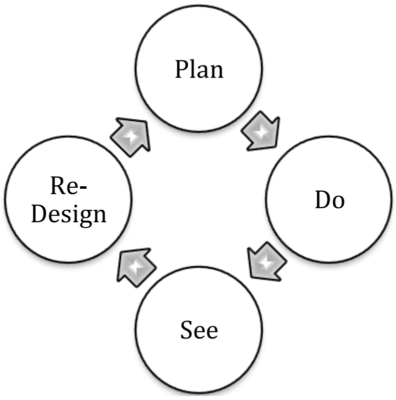

Figure 1. The Research Study Procedure

The research study was conducted in the lecture of Integral Calculus courses at the Study Program of Mathematics Education the Department of Mathematics and Science Education the Faculty of Teacher Training and Pedagogy the University of Bengkulu. The Subjects of this research study are students taking Integral Calculus courses at the Study Program of Mathematics Education the Department of Mathematics and Science Education FKIP the University of Bengkulu in odd semester of the 2015/2016 academic year.

Data collection techniques in this research study used observations. The observations were focused on student interactions in the learning process. A class observation is an activity to work out facts in classrooms that previously undetected by teachers (Tsukui, 2015).Observation of students performed per group. The observations are carried out without observation sheets in order not to limit the observers in making observations. Findings during the observations in the learning process were written and recorded in the form video. In analysing data, data obtained from this researchstudy was reduced to summarize, pick things that were important and focus data in accordance with the purposes of research. Then the data was presented descriptively, afterward conclusions are made.

C. FINDINGS AND DISCUSSION

1. Findings

a. The Planning of Open Lesson 1

There were 6 observers. In the planning, the schedule of open lessons, the technique of the implementation of the open lesson, the instruments need to be prepared, and learning scenarios are discussed.

b. The Implementation of Open Lesson 1

The open lesson 1 was conducted at Class A III semester III in Integral Calculus course with material Total Riemann and Integral Calculation. The students were divided into 6 groups. Each group was observed by an observer. In this class, two trailer chairs are found, they are in Group 2 and Group 3, but their positionswere set so that when the forming groups, this chair would not need to be rotated. From four exercises that were given, most students just completed three exercises.

c. The Reflection of Open Lesson 1

1) Group 1

<table>
<tr><td rowspan="2">ATU</td><td>SUP</td><td>SFD</td><td>PU</td></tr>
<tr><td>II</td><td>PGS</td><td>CSP</td></tr>
</table>

Figure 2. The Seating Chart of Group 1 in Open Lesson 1

a) Two students did not have the textbook, they were PGS and CSP.
b) When the lecturer explained the lesson at the beginning of the meeting, PGS always looked down and only occasionally paid attention to the lecturer.
c) SFD made notes on the textbook and ATU did it on a notebook.
d) PGS strived to listen but stared down, did not paid attention to the lecturer.
e) When the lecturer asked the students to work on problems, PGS looked toward CSP.
f) In the discussion, when student began the discussion in pair, CSP shared the book with PGS, but had more discussion with ATU.
g) II tried to work on her own.
h) ATU and SU used calculator tools.
i) Through group discussions, the students learnt and shared information eventhough they did not discuss as a whole group. There were several small groups in this group.
j) The students still learn individually.

2) Group 2

<table>
<tr><td>SA</td><td>FT</td><td>JP</td><td rowspan="2">MY</td></tr>
<tr><td>BDS</td><td>ES</td><td>TF</td></tr>
</table>

Figure 3. The Seating Chart of Group 2 in Open Lesson 1

a) When the lecturer explained the lesson, the students read the textbook, while they were paying attention to the explanation of the lecturer.
b) When the lecturer explained the lesson, FT and BDS made a note on the textbook, while SA and JP did it on notebooks.
c) Because there were no group labels, the lecturer made mistakes in mentioning the name of the group.

d) The students in this group did not work as a group optimally. When the students were sitting face-to-face, the students were still doing exercises on their own, there were no discussions, and this happened until the end of the grouping.

3) Group 3

<table>
<tr><td rowspan="2">AH</td><td>AA</td><td>AM</td><td>NPS</td></tr>
<tr><td>LA</td><td>BSA</td><td>IPS</td></tr>
</table>

Figure 4. The Seating Chart of Group 3 in Open Lesson 1

a) At the beginning of the lecture's explanation, the students did not fully paid attention to it. They still looked for the pages in the textbook.
b) When the lecturer explained the lesson, the students tended to only read the textbook and made a note on the textbook.They did not write it on notebooks.
c) When the lecturer gave problems to be worked out in groups, at the first 10 minutes, the students work individually eventhough they seated in a group, afterwards it changed, 3 students discussed, 3 students only looked at them, while 2 students worked on their own.

4) Group 4

<table>
<tr><td>RP</td><td>ZIS</td><td>FSS</td><td rowspan="2">NRW</td></tr>
<tr><td>CGH</td><td>RF</td><td>FRW</td></tr>
</table>

Figure 5. The Seating Chart of Group 4 in Open Lesson 1

a) Some students in this group did exercises by using a pencil, for example ZIS.
b) When the lecturer asked questions, the students in this group did things that were not relevant, namely CGH shut up his mouth and FRW played pen.
c) The filing of the attendance list disrupted the learning process.
d) When the lecturer asked students to do exercises in groups, the students in this group still worked individually.

5) Group 5

AN	IH	RNS
AMP	CJS	P

Figure 6. The Seating Chart of Group 5 in Open Lesson 1

a) The students still frequent answered questions simultaneous in learning process.
b) The students did not get eye contacts from the lecturer.
c) At the time of doing exercises, group works did not work at the beginning and no one in this group could answer the questions.
d) Only P requested lecturer's guidance to the solve problem of the exercise number 1, while the other group members did not.
e) There was no discussion as the whole group, only two students discussed, namely RNS and IH, so there was lack of the function of the group.
f) When the lecture requested the students to sit in a form of a group, the students began to interact among them.
g) When this group was asked to present an answer in front of the class, P did it, while other members did not aware of what P did.

6) Group 6

EH	PM	EDA
MDN	SJ	AAM

Figure 7. The Seating Chart of Group 6 in Open Lesson 1

a) Some students, for example AAM, did not pay attention to the lecturer's explanation, they looked at the textbook.
b) Some students, for example SJ, made a note not based on the lecturer's explanation, but he copiedinformation from the textbook.
c) EH discussed previous assignments with PM when the lecturer explained learning materials, although the discussion was via writing on a paper.
d) Some students did not pay attention to the lecturer. They tried to work out the problems by themselves.
e) Some students did not understand the exercises.
f) Some students were still slow in mathematical computation particularly in number operations, such as the sum of negative numbers or the square of negative numbers.
g) Some students were still confused in choosing formula to answer the problems.
h) When group discussions were formed, this group tended to be passive, worked individually, and they were lack of interaction among group members.

d) Redesign of Learning of Open Lesson 1

1) The media should be prepared to facilitate the students to discuss in groups.
2) The number of exercises are reduced and adjusted to the time allocation.
3) The questions from the lecturer should not be answered classically, but the lecturer appoints a particular student to answer.
4) The trailer chairs should not be used so that the formation of groups can be more flexible.
5) Giving the observers seating charts per group with a space to write down the results of observations for eachstudent on the seating chart.

e) The Planning of Open Lesson 2

The lecturer created teaching planning based on the finding from the open lesson 1 and provided media, newsprints and board markers, to facilitate the students to discuss in groups. Seating charts per group with a space to write down the results of observations for each student on the seating chart are also prepared.

f) The Implementation of Open Lesson 2

The open lesson 2 was conducted at Class B III semester III in Integral Calculus course with material same as in Open Lesson 1, Total Riemann and Integral Calculation. There were 6 groups in this class and an observer observed one group.

g) The Reflection of Open Lesson 2

1) Group 1

<table>
<tr><td rowspan="2">LP</td><td>RNN</td><td>NF</td><td>FP</td></tr>
<tr><td>RN</td><td>APS</td><td>HW</td></tr>
</table>

Figure 8. The Seating Chart of Group 1 in Open Lesson 2

a) All students carried the textbook.
b) RN looked tense (uncomfortable) from the beginning of the lecture, he always looked down.

c) APS just looked down and did not make a note, HW made a note on a paper, while FP and RNN did it on the textbook.
d) LP answered the lecturer's questions, but she was still doubts.
e) When the lecturer explained the textbook page 226, RN opened page 224.
f) When the lecturer gave assignments and other students began to work on the problems, RN still thumbed back the textbook.
g) When do the group task, the APS took a role as a scribe in the group and she just copied the answers from her friends, while RN was still cool.
h) RNdid not join with other group members, only LP, RNN, NF and FP discussed the problems, although the students had been given a newsprint as media to facilitate them in discussion, firstly theystill tried to work on their own or just talkedto friends who were nearby.
i) The cooperation as a team had not existed in this group.

2) Group 2

<table>
<tr><td>YNA</td><td>SA</td><td>TP</td><td rowspan="2">GV</td></tr>
<tr><td>ASB</td><td>SB</td><td>SDP</td></tr>
</table>

Figure 9. The Seating Chart of Group 2 in Open Lesson 2

a) SA was not present.
b) YNA, TP, GV, ASB, and SB had started reading the material before the lecture began and after the lecture began, the students still read the materials.
c) GV and SDP made a note on the textbook, while the YNA did it in a notebook.
d) YNA thumbed backthe textbook to find answers of questions asked by the lecturer.
e) TP and GV seated next to each other.They discussed the answers of the lecturer's questions in the style of stealth with the mouth shut with a book.
f) SDP divided the group members to work on the problems. One question is answered by two group members. They did not discuss it in a group.
g) TP and GV, without any confirmation to the other group members who were still busy with their problems, wrote their answer on the newsprint on the floor.
h) When other groups already worked on the assignment on the floor, YNA, ASB, SB, and the SDP were still busy with their own problem.
i) When TP and GV finished writing the newsprint on the floor, YNA, ASB, SB, and SDP were still busy with their problem, then TP and GV helped other group members who unfinished.
j) YNA and SB represented their pair wrote their answers on the newsprint.

3) Group 3

<table>
<tr><td rowspan="2">NA</td><td>EM</td><td>BT</td><td>CMS</td></tr>
<tr><td>RBS</td><td>WAA</td><td>SJ</td></tr>
</table>

Figure 10. The Seating Chart of Group 3 in Open Lesson 2

a) When the lecturer explained the lesson at the beginning of the meeting, the students had serious attention to the lecturer but they did not write down the lecturer's explanation.
b) The students made a note on their textbook.
c) When asked by the lecturer, the students could not answer and tended to be silent, therefore the lecturer had to answer the questions.

d) When the students were given an opportunity to ask the questions about things that have not been clear, no students asked it.
e) In doing exercises in groups, about the first 10 minutes, two students discussed the exercises, other students work by their own. Then about the next 20 minutes, 4 students discussed it,they were NA, RBS, EM, and WAA, while BT, CMS, and SJ worked individually.
f) After the lecturer distributednewsprint to each group and allowed students to sit on the floor to work on the problems, there was an increasing of cooperation as a group.
g) When the group's work was patchedon the walls, this group seemed to feel more satisfy on their results compare to other groups.

4) Group 4

TF	RB	IPS
AH	UDV	NDJ

Figure 11. The Seating Chart of Group 4 in Open Lesson 2

a) At the beginning of the lecture, the students paid attention to the lecturer's explanation and the lecturer asked questions to check the students' understanding.The students paid attention to the lecturer's questions and tried to find out the answers.
b) When the lecturer explained the lesson, IPS and RB made a note in the textbook.
c) When the lecturer explained the lesson, AH and NDJ closed the textbook and paid attention to thelecturer's explanations.
d) Discussions already existed in this group and the students soughtthe solutions of the problems soon.
e) In group activities, RB and IPS discussed to find the solution of the problems, while other group members prepared answers to be written on the newsprints.

5) Group 5

H	AS	ARA
ARJ	RA	YR

Figure 12. The Seating Chart of Group 5 in Open Lesson 2

a) All the members of this group made a note in the textbook.
b) AS could not answered the prerequisite questions from the lecturer.
c) ARA could answer the lecturer' questions, after that ARJ, RA, YR asked him how to get the answer, ARA explained it briefly with the position of his body still facing forward.
d) ARJ used a pencil and a pen that he held together. At the beginning of the learning, he had many discussions with RA and YR whose positions of the seat in a row, butARJ had many discussions with H in the group discussion time.
e) At the beginning of the group discussion, all members of this group worked on their book, even though thenewsprint had been provided, the newsprint just was put beside the seat.
f) RA takes the role as a minute. When RA wrote on the newsprint, other members of thisgroup worked on the next questions, but the discussion was only between two students, for example H and ARJ, AS watched and dictated RA who was the minute.
g) Participation of all members of the groupexisted at the end of the working group.
h) When the lecturer instructed the students to patch the work on the wall, this group did not focused on the instruction because they still worked on the last question.
i) When all the questions completed, all members of the group applauded as an appreciation of their results.
j) All members of the group participated topatch the newsprints.

6) Group 6

NR	RDA	RMS
LEN	AR	HBT

Figure 13. The Seating Chart of Group 6 in Open Lesson 2

a) The students had lack of responses to the lecturer when they were asked questions and when the lecturer asked whether they had understood or not.
b) Only RDA had a response when the lecturer asked questions and when the lecturer asked whether the students had understood or not, RDA interact with RMS, a friend next to him, when the lecturer asked questions to members of other groups.
c) While waiting for the lecture began, other students read the material in textbooks, AR was still relaxed.
d) When the lecturer explained the lesson in front the class, AR did not made a note at all, NR wrote behind of a copy paper and not on a notebook, LEN did not had a notebook, she just made a noteon the textbook and highlighted the important parts of the textbook, and HBT was the only member of the group who brought a notebook and wrote down the lecturer's explanation.
e) This group had slow response. When other groups had started work together in doing exercises on the floor, this group had not.
f) There was a lack of cooperation among group members. The assignment was only charged to one of the group members, namely RDS. LEN was asminute in this group, while other members, NR, RMS, AR, and HBT were busy themselves, not active in group discussions

h) Redesign of Learning of Open Lesson 2

1. The lecturer has to give detailed instructions related to the use of media
2. The lecturer has to monitor students' activities in discussion groups by approaching each group and explaining problems or questions that they do not understand.
3. Adjust the seat so that the media used to write answers will be visible to all members of the group.

2. Discussion

There was still a lack of mutual learning among students in one group. This was because they were used to apply individual learning. The students still had a perception that the groups were formed aiming to work together in solving problems, not to learn from each other. For example, in the open lesson 2,Group 2 divided the group into three smaller groups consisting of two students that were responsible for completing one number of exercises. As another example, two members of Group 4 discussed solutions, while other group members wrote it on the newsprints. Several students did not want to join the groups. This shows that the existence of mutual listening activities among learners as a form of the philosophy of democracy in community learning explained by Sato (2012) did not work in this learning process. There was still lack of collaborative learning among students. In collaborative learning, students have the main role to ensure the opportunity to participate in high-quality education for all learners, learners can trust and learn from each other comfortably, learners can share things that have been understandable and have not been understood through interacting and inspiring each other to increase learning spirit (Ueno, 2015).

The findings in this research study that the trailer chairs should not be used in the learning process andarranged the seat so that media can be visible to all group members was in line with Kitada (2015) explaining that convenient groups is one of elements in collaborative learning. If the circumstances support students to work collaboratively, learning community among students can work well. In addition, the implementation of open lesson was also improved in open lesson 2. The observers were given seating charts per group and it has a space to make a note the results of observations for each student. This shows that lesson study can be developed step by step in schools (Chichibu &Kihara, 2013).

LSLC activities required cooperation from all parties concerned to make it easier to invite lecturers in conducting an open lesson as a model lecturer or as an observer as well as to arrange the schedule and to implement open lessons. This was suit to Saito, Murase, Tsukui, and Yeo (2015) that explain learning community needs collaborative learning and also collegiality and partnership among educators.

Media that supports collaborative learning is also one element in collaborative learning (Kitada, 2015). We can see the differences of findings in open lesson 1 and open lesson 2 in which media to facilitate students to discuss the solutions of problems were provided in open lesson 2, while this was not in open lesson 1. Even though still many students worked individually, students had more discussion among them and working together as a group in open lesson 2. Media were needed to facilitate students to collaborate. Besides the media, availability of the sufficient number ofrecording devices to carry out observations was also needed in the implementation of open lessons.

Furthermore, several students who did not want to join the groups that were found in the observation need a special attention. The lecturers, as the model lecturer and the observers, got input from reflections in the open lessons. We can see that in the planning open lesson 2, the lecturer improved his teaching planning and provided media based on the reflection from the open lesson 1. Lesson study can make educators to be more professional in teaching (Hurd& Lewis, 2011)

D. CONCLUSION AND RECOMMENDATIONS

From the result of this research can be concluded that:

1. Problems experienced by students:
   a. There was still a lack of mutual learning between students in one group because learning applied during this was individual.
   b. Students still had perceptions that the groups were aimed to work together in solving problems, not to learn from each other.
   c. There were still students who did not want to join the groups.
2. Lesson learned:
   a. LSLC activities required cooperation from all parties concerned to make it easier to invite lecturers to conduct open lessons or become an observer as well as to arrange schedules and implementation of open lessons.
   b. Media was required to facilitate students to collaborate.
   c. Sufficient number of recording devices was needed to carry out observations.
   d. Students who did not want to join the groups needed special attentions.

E. RECOMMENDATIONS

Based on the result of this research, it is recommended that:

1. All stakeholders should support and engage in LSLC.
2. The results found in open lesson activities should be used as an input study programs, departments, faculties, and universities to improve the quality of Instructional processes.

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DEVELOPMENT CONSTRUCTIVISM LEARNING MATERIALS USE PROBLEM BASED LEARNING MODELAT FIFTH CLASS OF ELEMENTARY SCHOOL

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Abstract

Based on an observation and interview on the Mathematics Padang Panjang teachers, it was found that the instructional materials they used have not yet facilitate the students to construct their own learning in Mathematics. The purposes of this research were to develop a Constructivism learning materials for 5th Grade Elementary School students in Padang Panjang, consisted of lesson plan and student worksheet. The learning materials were developed use models Problem Based Learning. This research was a combination of Research and Development (R & D) and Experimental.Based on the data analysis,the findings of the teaching materials using problem based learning models in this study are: (1) The instructional materials for 5th Grade Mathematics was found "valid" for its content and construct. (2) The instructional materials which had been developed fulfill the practicality and that it can be easily used by the teachers without any difficulty. The conclusion of this research is that the materials with problem based learning model are: (1) In general, the worksheet is valid, and can be used with minor revisions, (2) The compiled lesson plan is valid and can be used with minor revisions, (3) Theworksheets and lesson plans produced have good practicalities.

Keywords— *Constructivism, problem based learning, validity, practicality.*

INTRODUCTION

Quality of life of a nation is determined by factors of education, because education role is to create a generation of smart, building a life that is peaceful, open, and democratic. The progress of a nation can only be achieved through compliance with good education. Efforts to improve the quality of education is expected to raise the dignity of the human in Indonesia. To achieve this, education must be adaptive to the changing times. Various attempts have been and are being made by government to improve the quality of national education, one of which is the improvement of the curriculum. Completion of the curriculum should be done to respond to the demands of the democratic life, globalization, and regional autonomy. In the coming era, expanded educational functions include basic human rights, economic capital, social and political, the cornerstone of a culture of peace and as the main road leading to the community of lifelong learning. Based on that idea, the curriculum needs to be developed with a competency-based approach, so that national education graduates have a competitive advantage and comparative appropriate national and international quality standards.

The learning objectives in elementary school (SD) in accordance with the purpose of primary education, namely; provide supplies to students the basic ability to develop life as a private, community members, citizens, and members of the human race as well as prepare them for secondary education. Related to mathematics, in KTSP declared four functions of mathematics in primary schools, namely: (1) Train the way of thinking and reasoning in drawing conclusions, (2) Develop creative activities involving imagination, intuition and curiosity, (3) Develop problem-solving ability, and (4) Develop communication skills, especially to convey the idea (ideas) with oral, chart notes, or any other form (Depdiknas, 2006).

Related to the above functions of mathematics learning, the observation in schools showed that exercise reasoning skills, problem solving, and communication has not been entrenched to this day. Most students are accustomed to learning by hearing the teacher's explanations, copy and memorize it. As a result, most students is only able to present a good level of memorization of the material it receives, but in fact they often do not understand the substance of the material. Facts show that students are largely unable to link between what they learn with how the knowledge will be used or exploited.

Based on field observations and interviews with some of the elementary school teachers in the city of Padang Panjang, also revealed that the study of mathematics is still likely to take place in one direction, from the teacher to the student. Generally, the pattern of learning at every meeting that applied by teachers are: to explain the subject matter, give examples of the application, provide training, and at the end of the lesson the teacher gives homework. Learning patterns like this are called Conventional Learning. On learning this way, students tend to be passive, teachers dominate the classroom, and the teacher-centered learning.

The learning methods are implemented less meaningful and mathematical concepts simply understood as rote. As a result, the concept is easily forgotten and often even a mathematical concept misunderstood by students. This causes the students are not able to apply properly the concepts they have learned in completing practice questions. The problems described above, compounded by the conditions of teaching materials (textbooks) is not conducive to the creation of a conducive learning condition. Textbooks are more widely used as a handbook of teachers, and they present lessons exactly the same as what is in the textbooks. This is because teachers have not designed a learning device that is able to accommodate the needs of students to learn actively. The description contained in textbooks tend to make students memorize, without understanding what they learn, since the material presented less related to the real world of students.

To resolve this issue, is necessary to the development of learning tools based on cognitive theory, which includes the theory of constructivism. According to the theory of constructivism, thinking skills, problem solving, and communication can be developed if the students do themselves, discover and construct knowledge that exists (Slavin, 1994). Based on this theory, it is believed that the use of models of learning with contextual approach, in which this approach has a constructivist philosophy, will be able to create meaningful learning of mathematics.

In a constructivist classroom, a teacher does not teach students how to solve problems, but presented problems and to encourage students to find their own way in solving the problem (Kamii, 1990). With a constructivist approach, mathematical activity can be realized through the presentation of the problem, working in pairs, or in small groups and class discussions. So, learning the constructivist approach should be designed with problem-solving approach, where teachers and students are bound in talks that have mathematical meaning.

Based on observation and discussion from investigators with primary teachers in Padang Panjang, obtained information and the fact that they have not skilled in developing devices based learning problem-based learning. Therefore, the results of this study are expected to be a model for mathematics teachers in preparing and organizing the learning of mathematics more meaningful. Through this study, the device was designed based math learning using the constructivist learning model associated with the contextual approach. Model of applied learning is Problem Based Learning.

2. REVIEW OF RELATED THEORY

2.1. Mathematics Learning

According to the traditional view, learning is considered as an addition and a collection of a number of sciences. This of course is a very narrow view. Learning is not only defined as a collection of a number of additions and science, but also a process that can bring about change in individuals. These changes occur from not knowing to knowing the master of science (Roestiyah, 1986: 8).

According to the theory of learning Gagne (Suherman, 2003: 33) argues that in mathematics there are two objects are obtained by the students is the direct object and indirect object. Indirect object, among others, the ability to investigate and solve problems, learn to be independent and know how to properly learn. While the direct object in the form of facts, skills, concepts, and rules.

Based on the above theory, can be explained that upon learning of mathematics students will find a wide range of facts, skills, concepts and specific rules. Students must have the ability to investigate, solve problems, learn to be independent and know how to learn the right to be able to interact with the situation. It requires students to learn and participate actively in learning.

2.2. The Development of Prototype

In developing learning tools must consider the following criteria: (1) can be helpful for learning activities of individuals / groups, (2) can respond to the maximum, (3) containing the message, potentially, (4) is able to provide learning opportunities that are of interest, (5) provide advice, guidance and information feedback about the level of students' learning progress achieved. It further requires the pillars and dimensions as the support of a solid learning to tejadinya learning process effective and efficient. The results of the systems approach is expected to solve the problems of learning effectively and efficiently.

In connection with the above, the model used in the development of elementary mathematics learning devices are Degeng Model (1994), which consists of eight steps as follows.

a. Analysis Objectives and Characteristics Field of Study
b. Analysis of Learning Resources
c. Analysis of Student Characteristics
d. Goal Setting Learning and Content Learning
e. Establish Strategy Organization of the material
f. Assign Delivery Strategy Learning Materials
g. Establish Management Strategy Learning
h. Development of Measurement Procedure Learning Outcomes

Learning device to be designed are worksheets and lesson plans. The device in the form of worksheets is expected to provide opportunities for students to work in order to menerapan mathematical concepts through discussion groups. Furthermore, the lesson plans is expected to help teachers and students in the learning process in a structured and systematic way.

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2.. Problem Based Learning

Problem Based Learning Model is characterized by the use of real-world problems. This model can be used to train and improve the skills to think critically and solve problems, and get the important concepts. This learning approach prioritizes the learning process, where the duties of teachers should focus on helping students achieve self-directing skills. Problem Based Learning to use the higher-level thinking, problem-oriented situations, including how to learn (Arends, 1998). This opinion is in line with research findings Adams, et al (in Slavin, 1994), that a combination of thinking skills by learning in a particular field of study, the results provide a better hope.

Problem based learning can only take place if the teacher can create a classroom environment that is open and guiding the exchange of ideas (Arends, 1998). To that must be supported by adequate learning resources for students, tools for test answers or allegations, curriculum supplies, availability of sufficient time, as well as the ability of teachers to lift and formulate problems (Sujana, 2002) so that learning objectives can be achieved.

Results of research Terry Wood and Patricia Sellers (in Arends, 1998) showed that results for students with learning centered on the issue is at a good level. Comparison between the learning outcomes of students with learning centered on significantly higher than students who studied with traditional algorithms.According Arends (1998) Problem Based Learning model implementation includes five stages. The five steps can be seen in Table 1 below.

Table 1. Syntax Problem Based Learning Model

Phase	The role of teachers
Phase 1, Orientation of students in trouble	At this stage the teacher explains the learning objectives, explain the necessary logistics, motivate students engage in problem-solving activities, and pose a problem
Phase 2, organizing students	At this stage the teacher divides the students into groups, helping students define and organize the task of learning-related problems.
Phase 3, Guiding the individual and group investigation	At this stage the teacher encourages students to collect appropriate information, carry out experiments and investigations to get an explanation and problem solving.
Phase 4, Develop and present work	At this stage, teachers help students in planning and preparing the appropriate work such as reports, videos, and models as well as help them to share duties with his friend.
Phase 5, Evaluate the problem solving process	At this stage the teacher helps the student to reflection or evaluation of their investigations and the processes they use.

3. THE METHOD OF RESEARCH

3.1. Type of Research

This type of research is a combination of research and experimental development. In connection with the products produced in the form of learning tool. The research activities are divided into two stages, namely; (I) the stage of preparation of a valid prototype device that aims to see the validity of the device, and (ii) the implementation phase, which aims to look at the practicalities of learning tools produced. The focus of research in stage I is produced prototype devices based learning PBL is valid in terms of content and structure. The measures undertaken in the preparation stage of a valid prototype device is as follows; (I) analysis of needs, (ii) a literature review, (iii) designing the prototype, (iv) validation of mathematics learning specialist, (v) revision, and (vi) the evaluation of the prototype. The research activity is the implementation of phase II prototype devices produced. The purpose of the studies focused to gain practical learning tools. The criteria used to assess the practicalities of learning tools is the feasibility and enforceability

3.2. Research of instrument

The instrument used for the data collection are as follows.

1. Sheet validation, to collect outcome data validation learning device.
2. Guidelines for the interview, used to gather opinion data of students and teachers about the problem-based learning.
3. Observation sheet, to collect data about the practicalities of learning, especially the feasibility and enforceability of the device are arranged.

3.3. Step of Prototype Design

Step-by-step development of instruments that do the following:

1. Validation Sheet

   Sheets validation required to obtain data regarding the validity of the device are lesson plans and worksheet validation sheet.
2. Interview Guide

   Interview guidelines contains aspects that will be the focus of the question, which aims to direct researchers obtain the information necessary to develop learning devices and acquire data practicalities of the resulting device.
3. Observation Sheet

   Observation sheet contains aspects that will be the focus of observation of the learning process for the analysis of needs, and obtain data on the practicalities of the device.

3.4. Technique of Data Analysis

Data obtained from classroom observation, interviews, and questionnaires were tabulated, described, and analyzed descriptively qualitative accordance with established criteria.

4. FINDINGS AND ANALYSIS

4.1. Description of Results Data Development and Implementation Tools

Data from the device development related to the validity and practicalities, presented descriptively.

4.1.1. Validity of prototype

The focus of research at this stage is produced prototype based problem based learning models for elementary fifth grade students on the topic Flat Build and 3-dimention valid in terms of content and construct.

a. Analysis of needs

1) Conducting interviews with 12 teacher of Math Class Grade 5 elementary school in Padang Panjang

Based on interviews conducted obtained information that the teacher's perception of the nature of mathematics, and the interest of teachers to improve the quality of teaching is good enough. All the teachers interviewed also had positive views and thoughts on mathematics,

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because for these three aspects of more than 80% of teachers expressed positive views and thoughts, even though the experience of teachers in preparing and using problem based learning of tools is still not good. In fact, not one teacher who is experienced in preparing worksheets and lesson plans.

2) Interview of students

Data from interviews showed that students have a positive outlook towards mathematics. That is, they view that mathematics is a science that is important to learn and helpful in solving everyday problems. They love to learn math and have a great curiosity about the science of mathematics. But they are less happy reading textbooks. As for the learning experience of students using materials other than textbooks obtained information that only students from the elementary group experienced high use learning resources other than textbooks.

3) Observe Textbooks and Prorotype Used by Teachers

The results of observations of the textbooks used by teachers, showed that the types and kinds of text books that circulated in schools today are many and varied. Generally textbooks used not fully support efforts to make students in "finding" a mathematical concept, explanation of the concept and practice still tend mechanistic and lack the ability to train students to solve problems.

4) Observation Of Mathematics Learning

Observations of mathematics learning is done at 3 SD group representing high, medium, and low. The results showed that teachers tend to teach activity than membelajarkan give examples of problems, and then the students practice to solve problems that are similar to the sample questions provided by the teacher.

5) Reviewof Prototype

Review was conducted in order to obtain suggestions for improvements to the draft prepared by the teacher, before being validated by experts. 'Review the activities carried out through focuss group discussion (FGD) with mentors, supervisors and teachers of the elementary school where the trial.

b. Design of Prorotype

Activity preparation the Problem Based Learning of prototype that do can be explained as follows:

1) Analyze Lessons Math Grade 5 Elementary School in the First Semester

The scope of the material is arranged is geometry, with the following material.

a) Plane of rectangular
b) Three-dimentional figure

2) Conducting arrangement of tools

Workshop involves maths teachers from the elementary school where the experiment all three groups. The workshop includes discussions, group work, self-employment, and the presentation of the draft. Prototype tools are arranged can be explained as follows:

a) Worksheets

The resulting prototype is a worksheet with problem based learning model. worksheet with problem based learning model, activities find broad trapezoid begins by observing a rectangular image made on the paper's puzzle, students are asked to determine the length and width. Then students are asked to calculate the area of a rectangle by counting the total number of units box. The next activity is cutting rectangle in a certain way (described in the worksheet), followed by the drafting of the corresponding rectangular cutout image provided on the worksheets.

Furthermore, students were asked to answer a number of questions, so that they can find a wide trapezoidal.

b) Lesson Plans

The resulting prototype is the lesson plans with problem based learning model. lesson plans and worksheet is a unity, so that the serial number of lesson plans and the worksheets are pairs.

c. Validation of Prototype

Validation involves 2 experts mathematics. Here are described the results of expert validation of the math-based problem based learning tools that have been developed.

1) The Worksheets

The following shows the results of validation the worksheets

Table 2. The result validation of worksheet

No	Aspect	Validator 1	Validator 2	Validator 3	Total Score	Percentage
1	Format	22	22	23	67	89,3
2	Content	27	25	26	78	86,6
3	Question	18	16	17	51	85
4	Language	22	20	23	65	86,7
Average						86,9

For more details, the data in Table 2 above are presented in the form of a bar chart below.

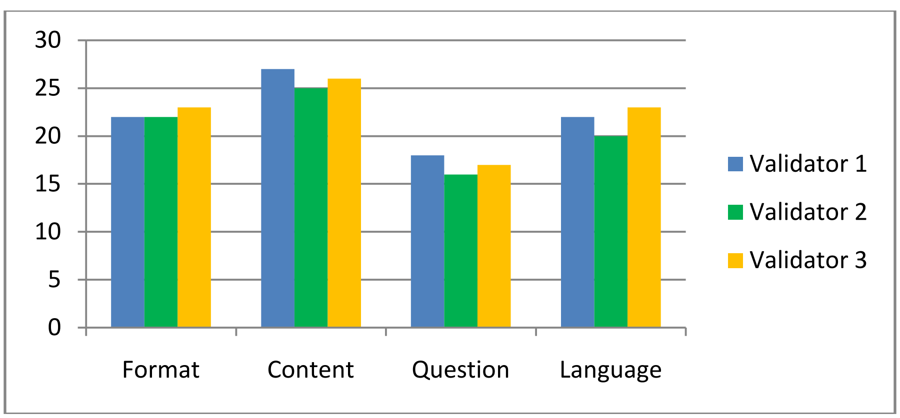

Figure1.The result validation of worksheet with problem based learning model

2) The Lesson Plans

The following shows the results of validation the lesson plans

Table 3. The result validation of lesson plans

No	Aspect	Validator 1	Validator 2	Validator 3	Total Score	Percentage
1	Format	4	4	4	12	100
2	Content	21	19	21	16	84,7
3	Reflecting the Problem Based Learning	4	4	4	12	100
Average						94,9

For more details, the data in Table 2 above are presented in the form of a bar chart below.

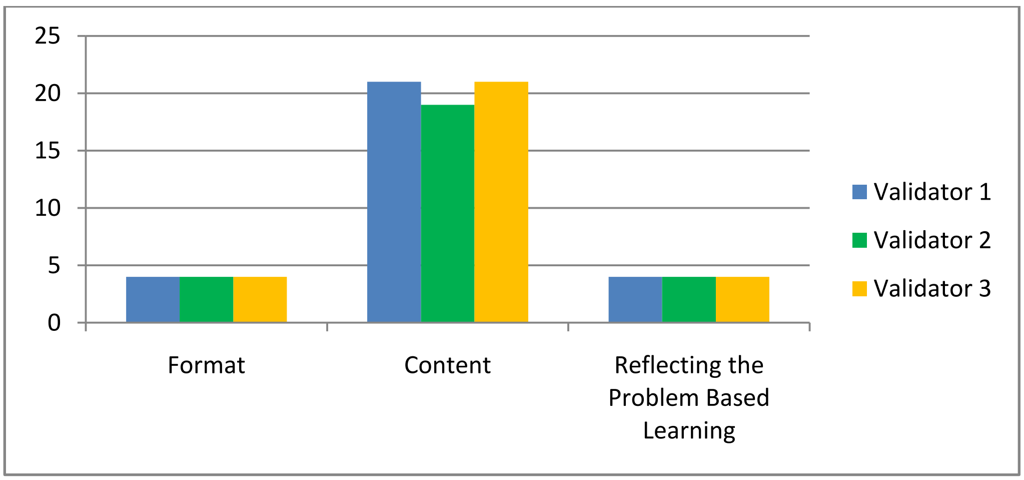

Figure2.The result validation of lesson plans with problem based learning model

The data in Table 3 shows that for every aspect to be between 84.7% and 100%, with an average of 94.9%. Overall the lesson plans with problem based learning model are valid, it can be seen from aspects the construction, the contents and syntax of activities have reflected the problem based learning model. It can be concluded that the lesson plans can be used with little revision. Some suggestions validator are:

a) group learning materials into mathematical objects, namely: facts, principles, concepts, and procedures.
b) improve the writing of sentences and words that are not according to the rules of Indonesian well and correctly.
c) adjust the allocation of time for each phase of student activities to be performed
d) include clear and specific media and props used

4.1.2. Practicalityof Prototype

Practicality prototype tools produced viewed through the test results at 9 school.

a. Testing and Implementation Tools

The prototype tools has been validated, revised, and tested on a limited basis in 9 elementary schools in the city of Padang Panjang

b. The Result of Class Observation

Based on classroom observations were carried out can be seen that in terms of legibility, students can use the worksheets without undue difficulty. Furthermore, it also can be seen that the tools are used to help students learn individually or in groups. By using a prototype tools that generated the mathematical activity can be realized through the presentation of the problem, working in small groups and class discussions.

Ease of use of the prototype tools is also evidenced by the lack of questions that arise from the students during learning activities. That is the language that is used in questions and tasks are listed in easy to understand student worksheets, so it does not need a lot of guidance from the teacher. Based on observations, in general the "performance" of teachers in implementing the learning using the problem based learning model is quite good.

c. The Result of Interview

To obtain more complete data on the practicalities of the prototype that has been arranged, conducted interviews with students.

4.2. Finding

4.2.1.Validity of Prototype

1) The Worksheet

The results of validation showed that the percentage values for each aspect to be between 85 to 89.3, with an average of 86.9. This indicates that the worksheets that are arranged in the category is valid, and can be used with minor revision.

2) The Lesson Plan

The result of validation showed that the percentage values for each aspect to be between 84,7 to 100 with an average of 94.9. It showed that the lesson plan compiled in the category is valid, and can be used with minor revisions.

4.2.2. Practicality of Prototype

In general the results of the practicalities of data can be as described below.

a. Students are easy to use worksheets, it can be seen from the lack of questions students when learning. The condition also indicates that a language easily understood by students.
b. Shiva helped in learning to use worksheets with problem based learning models, both when studying individual or group.
c. The resulting device is also able to facilitate students' learning according to their interests, and arouse their creativity in solving the problems given in the worksheet. Students also become accustomed to communicate their ideas through group discussions, and presentation of the group's work.
d. Teachers easily implement the lesson plan, it can be seen from the enforceability of the problem based learning models. The condition also indicates that teachers already understand the syntax of the problem based learning models well.

5. CONCLUSION AND SUGGESTION

5.1. Conclusions

The finding of research comes up to two conclusions, those are:

a. Worksheet compiled in the category is valid, and can be used with minor revisions.
b. Lesson plan compiled in the category is valid, and can be used with minor revisions.
c. Prototype worksheets and lesson plans produced has good practicalities

5.2. Suggestion

Taken from the result of research, there will be suggestion occurred, such as:

a. Elementary school teachers need to use problem based learning models of prototype that have been developed.
b. Elementary teachers should be able to develop a learning tool similar to other mathematical topics.
c. Elementary school teachers are expected through the forum Teachers Working Group (KKG) may revise the prototype that have been generated, primarily to adjust the level of difficulty about, and the amount of matter in the allocation of time to complete.

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The Development of *Cabri 3D* Module for Teaching Plane and Space at Junior High School Student

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Abstract

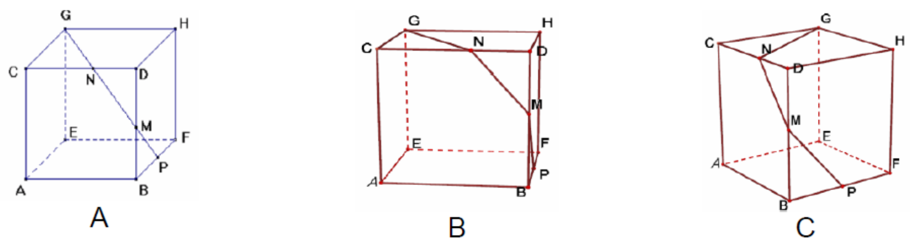
Dynamic geometry software such as Cabri 3D software is one of the visual media that can be used by teachers and students in learning geometry. Use of this software aims to visualize geometric objects that are abstract geometry so that learning is more meaningful, especially for students. The purpose of this research is to develop technology-based teaching module that is used to run the software Cabri 3D in topic of Space to meet the content validity and construct validity. The development of this module development use the Plomp model, but only carried out until the fourth phase is the initial phase of the investigation; design phase; realization/construction phase; and the test phase, evaluation and revision phase. These results indicate that the 3d Cabri software moduleis fullfill the criteria of content validity and construct validity. In terms of the content seen on the suitability of the topic of Space in Curriculum 2013 and the level of junior class VIII student thinking, while in terms of the constructs seen from the presentation of material grouped well so easy to use by teachers and students, and design as well as a simple display and communicative. Based on this, the Department of Education, the school, especially teachers and students can use this module to support learning in space at Junior High School.

Keywords: Module, Cabri 3D software, Space, validity

INTRODUCTION

Geometry of Space is one of the branchs of matemathics which has been taught since students were still studying in primary school, but in the reality the students' ability in solving three dimensional questions are still low. On materials of Plane and Space, the students had a difficulty to identify differences between a cube and a block because of a presentation in the picture requires square form to be converted into rhombus form. Then, based on survey results of Programme for International Student Assessment (PISA) 2000/2001, it shows that students having a weakness in geometry, especially in understanding space and form Suwaji, 2008). Based on above case, a teacher is compelled to be able to create a learning process that be interesting, interactive, inspirative, joyful, challenging, and motivating students in order to make students can participate actively in learning. A teacher has a very important role in developing student ability and the teacher is required to be able to ensure everything in order to achieve the goal of learning objective. This is corresponding with a statement from Burger and Shauhnessy (Ikhsan, 2008) uttered that a chain of activity in learning has a positive impact on a student achievement, where the activity was indicated as physic activity as well as mental activity in learning. One of means that can be applied by teacher in learning process is by using Information Technology and Communication (ITC) in learning process to help the student in understanding the taught material.

Although in 2013 curriculum no more lessons ITC, but ITC still be used as a means or media learning to all learning, so so that teachers are required to control ITC that could support learning (Johar, 2015). The curriculum mean that ITC uses in learning can be done by means of using ITC as a tool for making the students more easier to perform calculation, writing, data processing etc. Presence of computer in learning process of mathematics has important role mainly in geometry material, which usuallyis abstract object. Peressini and Knut (Jiang, 2011) inform that the presence of computer in learning process gives a new way for students and teachers in presenting concepts more complex and can manipulates abstract objects. The use of computer makes students could directly process information in figure of multimedia and then it would trigger the students to be more actively in choosing, organizing, and intergrating visual and verbal information (Simanjuntak, 2013). One of the softwares can be used for learning geometry is *Dynamic Geometry Software* (*DGS*) Cabri 3D. The software is a three dimensional (3D) software that is quite interactive and can be used for making and constructing some varians of 3D shapes, which are connecting to geometry learning. Cabri 3D software is very effective to introduce three dimensional shape of geometry to students because it can demonstrate 3D shapes clearly. One of the advantages of the software is the capability to present visibly 3D pictures which usually are difficult to draw on a whiteboard (Accacina & Rogora, 2006). For example, an inaccuracy can be occurred when a cube is being drawn on a whiteboard, as shown the following pictures.



Note: On Fig. A, a cube is being drawn on a whiteboard. The inaccuracy which can occur is when students assume the points of G, N, M and P is collinear. By using software *Cabri 3,* Fig. A can be rotated as shown by Fig. B and Fig. C, as a result it can be proved if the points are not collinear (Accacina & Rogora, 2006).

Although some researches show that *software Cabri 3D* is very effective when used in learning process in a school mainly for teaching geometry, but software instruction regarding a teaching material either in English or Bahasa Indonesia is still difficult to find. Based on above issue, through this research, we develop the instruction modul of software Cabri 3D for materials of Plane and Spacethat taught in Class VIII, but the modul also can be used for teaching geometry in Class VII.

Based on above explanation, then formulation of problem of this research is "*How is the results of the development of Cabri 3D module for teaching materials of Plane and Space which have valid criteria*?".

METHOD

Subjects of this research are 22 students from Class VIII-7 of SMP Negeru 8 Banda Aceh, consisting of 7 male students and 15 female students. This research is a design research that constitute developing teaching modul that can be used for operating the Cabri 3D software especially for material of Plane and Space that fulfil valid criteria. The valid criteria are seen from validity of content and validity of construct. This can be known based on comments and advices of validator and colleague as well as several students in validation step. Developing model is refered on developing model of Plomp (1997) consisting of 5 phase, which are 1)Preliminary Investigation, 2) Design, 3) Realization, 4) Test, Evaluation, and Revision, 5) Implementation. However, this research was done only to Phase 4. This is because the phase of Implementation required long process and long time. Data collection were conducted through observation and interview for identifying the students respons on the module of Cabri 3D.

RESULT AND DISCUSSION

The activities carried out in four phase of Plomp (1997) developing model are described as follows:

1) **Preliminary investigation phase**

The activities done in this phase are (1) Conducting the analysis of curriculum in SMPN 8 Banda Aceh. Valid curriculum in this school is 2013 Curricullum that constitutes the latest curriculum prevailing in Indonesia. This curriculum demands student to master four core competencies, among them is knowledge and skills. The two competencies are expected for students not only to master taught material also have skills related to their knowledge, which is very usefull in their daily lives.The chosen material is Plane and Space, because this material is closer to the daily life of the students. Moreover, the students tend to memorize the pattern of this material but they do not understand the basic concept. This material was taught in class VIII in semester two with basic competency which is determining surface area and volume of a cube, a block, a prism, and a pyramid. However, this research only focuses on sub material of cube and block. (2) studying more specific the use of Cabri 3D software in learning geometry for the material of Plane and Space. This research was conducted in SMP Negeri 8 Banda Aceh. The school already has laboratory of computer, but all this time it was used for ITC subject only. Meanwhil, since the 2013 Curriculum enacted then the ITC subject is not included again as a subject because it has already been integrated with other subjects. This makes the laboratory not be used as a supporting subject of ITC, but it is just only used as a workshop room for teachers only. Therefore, through this research, we eager to maximize the use of the computer laboratory for helping students to understand mathematics subjects especially geometry, with the intention that can support the implementation of 2013 Curricullum which is integrating ITC in learning in class.

2) Design phase

In this phase, a module of Cabri 3D was designed to ease the use of Cabri 3D software for the material of Plane and Space. In addition, validation sheets for validator were prepared to validate the module, quize questions for the material of Plane and Space and some interview questions that will be given for five students to get information about how response of the students on the use of Cabri 3D module in operating Cabri 3D software for the material of Plane and Space.

3) Realization/construction phase

This phase is the next stage of design phase, so that the module of Cabri 3D, validation sheet and interview questions which has been arranged could be made for basis of preliminary design or we called it as prototype 1. The module as prototype 1 which has been designed then would be consulted by thesis superviseor for compatibility as a module that can smooth the progress of operating Cabri 3D software.

4) Test, evaluation, and revision phase

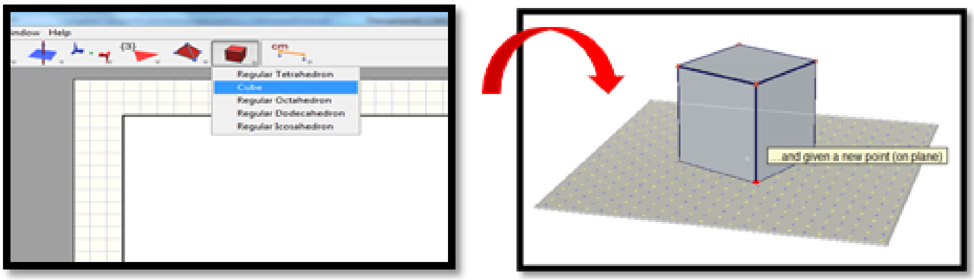
This phase was begin with validation stage on module of Cabri 3D for prototype 1 by three validator. In this case, validators that incorporated are instep with research direction and are very competent in their field especially in the material, language and technology/IT. Generally, based on judgement of the validator which including format, content, picture positioning and language in final stage and after finishing some revisions for Cabri 3D modul, they will give the same conclusion which states the module of Cabri 3D is already good and can be used for operating Cabri 3D software for the material of Plane and Space. Besides validation that is performed by two validators, 5 students were also included for checking the legibility of the module. Based on comment of the students gathered from module testing, the result shows that some sentences they read were still cannot be understood well. Moreover, in the trial tes, the students found some instructions of the module were not corresponding with picture, and consequently when the applied it in Cabri 3D software they could not follow what instruction was given in the module.

For validation results can be seen on the following table:

Before revision	After revision
Some words/languages used were unclear or can be understood well	Language/words used were clear and structured
Command “aktifkan” were indistinct or not match with picture	Command “aktifkan” were replaced with “Klik tanda panah”
Picture shown in the module were recurring	Picture shown in the module were already correct
Modul command were recurring	Modul command were already correct and eficient
Instructions in the modul directly carried the students to find elements of cube and block.	Instructions in the modul were just fo making certain command, for example, line and polygon.
Picture positioning were not proporsional	Picture positioning were already correct and match
There is only shown one way to construct a geometric.	There are several ways to construct a geometric.
Explanation for every tool on above panel was not given	Explanation for every tool on above panel was already given

Contoh kesalahan penggunaan bahasa

1. Membuat Kubus
    - Pilih **Cube** pada panel bagian atas.



    - Arahkan kursor pada bidang *Cabri 3D*, kemudian klik 1x sehingga muncul **pensil**.
    - Klik untuk menentukan letak kubus. posisi dan besar
    - Selanjutnya **drag**, sehingga bentuk kubus sesuai dengan yang diinginkan, kemudian klik untuk mengakhiri proses pembuatan kubus.
    - Aktifkan kursor yang ada pada sudut kiri panel atas, agar tidak terbentuk duplikat kubus yang lain. Klik tanda panah

Limited result of the trial test for prototype 1 that was conducted for three meeting with five students shows that the students were interested and fascinated in participating the trial test. This can be seen based on observation and comments of the students from given interview. The result of quiz test also shows that the five students could answer quiz question well with average score 78. The results of quiz, interview and questions of the students regarding module appereance were used next for fixing the module and checking the legibility in order the students can follow and use the module without difficulty.

Based on revision result, Cabri 3D module, which has been developed, has fulfilled valid criteria in terms of content and in terms of construct and then produced prototype 2. In terms of content mean that the suitability with concept of the material of Plane and Space that explained in Student Book (Buku Siswa) in 2013 Curricullum and level of thinking fo the students from class VIII. Whereas in terms of construct means the suitability with taxonomy stage of Bloom and material presentation grouped well, as well as simple design and appeareance and communicative. Furthermore, the instruction of the module has been explained clearly and the use of the language was easy to understand.

Protoype 2 that has fulfilled valid criteria then used for evaluation phase. This stage was done for 5 meeting and every meeting then was observed by one observer for checking the legibility of the module with Cabri 3D software and the taught material. The results of students quiz are shown on Table 2.

Tabel 2. Results of students quiz

Quiz	Sub Material	Score above KKM (%)	Max Score	Min Score
I	elements of cubes and blocks	20	85	45
II	Framework of cubes and blocks	50	85	60
III	Nets of cubes and blocks	60	90	60
IV	surface area of cubes and blocks	40	75	40
V	the volume of cubes and blocks	40	100	55

Based on observation, in the first meeting, the students were still not accustomed with computer use in learning. Results of interview with several students show they were still having difficulty with Cabri 3D software and then they required a relatively long time to understand the software, as a result time allocation planned was not proper with the material. In the second meeting, the two students had shown fascination to follow the teaching of Cabri 3D software with help of the module. The interview results with several students show that they became much easier to follow the instruction to understand the material with the help of Cabri 3D software. In the third meeting, the three students looked more excited in following the teaching using Cabri 3D software with help of the module. They admitted that the use of Cabri 3D module are very helpful for them in operationg Cabri 3D software, consequently they became easier to understand given material.

In the fourth meeting, there was a decrease of students' scores. Based on our observation, the students still looked enthusiastic to follow learning of the use of Cabri 3D with help of the module, but the decrease happened because there was a mistake from us when determining time allocation, as a result the students did not have enough time to finish the quiz. In the fifth meeting, three students successfully got the highest score. Based on interview with several students who got the lowest score, then we got information that the can follow the instruction of Cabri 3D modul, but they still had need of more time to apply it on computer. This happened because all this time they did not have the ability how to use computer, either in learning process or beyond learning process.

In general, the students looked enthusiastic and fascinated when following the learning of the use of Cabri 3D software with help of the Cabri 3D module. The students became more directed when following the given instruction in orde to ease them in operating Cabri 3D software. The use of Cabri 3D software in learning process was very helpful for the students to understand geometry because the software is very interactive in presenting shapes of three dimensional from various position Mithalal (2009).The students were much easier in learning the taught material of geometry because they could see directly how shapes of three dimensional space build are, which usually are difficult for them to imagine when the shapes drawn on whiteboard, as a result in the end it wouldhelp them to finish questions of the quiz.

CONCLUSION AND RECOMMENDATION

The development of Cabri 3D module for operating Cabri 3D software regarding material of PLANE AND SPACE in SMPN 8 Banda Aceh has fulfilled valid criteria. The valid criteria are seen in terms of contents and in terms of construct. In terms of content mean that the suitability with concept of the material of Plane and Space that explained in Student Book (Buku Siswa) in 2013 Curricullum and level of thinking fo the students from class VIII. Whereas in terms of construct means the suitability with taxonomy stage of Bloom and material presentation grouped well, as well as simple design and appeareance and communicative. Furthermore, the instruction of the module has been explained clearly and the use of the language was easy to understand. In addition, some recommendation of this research is that related individual and institution such as school, teachers, and students can use Cabri 3D module that is already valid to be used as a standard and an alternative in learning and teaching process especially in material of PLANE AND SPACE.

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A Study about Understanding the Concept of Force and Attitude towards Learning Physics on First-Year Students in the Course of General Physics; as Preliminary Investigation in Development Research

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Abstract

The concepts of science, including physics should be understood by students, because science is supporting the advancement of technology. But most students assume that learning physics is difficult because it is associated with physics equations or formulas. Students also had difficulty in understanding the concepts of physics, and even common misconceptions. This study aims to investigate the students understanding of the concept of force and know the attitude of students towards learning physics. Samples or subjects in this study were 43 students of the first year of physics education who has taken the course of General Physics. The data collection of research done in two ways, namely test (quantitative) and questionnaire (qualitative). Instruments to collect data about the understanding of physics concept style is a standard test FCI (Force Concept Inventory), and supported by data from a questionnaire about the reasons for choosing an answer. Instruments to know the attitude of students towards learning physics is a standard questionnaire CLASS (Colorado Learning Attitude about Science Survey). Test data were analyzed using t-test and questionnaire data were analyzed descriptively. The results showed that the students understanding of the concept of force is very low (≤ 50%). The majority of college students have misconceptions about force, especially the force on the vertical motion, circular motion, parabolic/projectile motion and a simple pendulum motion. Based on the analysis of student attitudes, found that; the students find it difficult to resolve the problems of physics concepts although they have understood the topic in question. Students also felt that the equations of physics do not support their ideas in understanding concepts of physics equations required only for a matter of course.These findings are discussed, and made initial design of development research on learning materials.

Keywords: concept of force, misconception, attitude towards learning physics

INTRODUCTION

Problems in learning physics that often arises is the difficulty of learners in understanding physics concepts. Physics is considered as a difficult subject and less fun because it is loaded with equations or formulas that are not easy to understand. This fact is often revealed by the recognition of the learners during the learning of General Physics or Fundamental Physics. This is reinforced by the results of research Putra (2013), which found that in general, students still feel the physics of matter that are in the category difficult. Three factors make it difficult physics are (1) the factor that comes from self-regulation of individual students, (2) factors derived from the arrangement by the manager of learning physics and (3) factors are derived from the inherent properties of materials physics. Olusola, et.al, (2012) also states that physics is regarded as a difficult subject for students ranging from middle school to university and also by adults in graduate education.

In addition, the observation and experience of the author of the new students at the beginning of the term of General Physics, too much going on student misconceptions in understanding of physics concepts, such misconceptions on the concept of ‘mass’ and ‘weight’. Many students who think the same concept of ‘mass’ and ‘weight’. This happens because in the daily life of students, the term ‘mass’ and ‘weight’ is no different. Though the two concepts in physics are very much different. The author also found the misconceptions of physics at the physics teacher who underwent PLPG activities, through observation during the implementation of peer teaching, not a few teachers who showed misconceptions, including the concept of force in the application of Newton's Laws; that the gravity and the normal force are pairs of force action and reaction (Newton's third law), and there is no force acting on a stationary object (Newton's first law), or misconceptions another: Newton's first law only applies to stationary objects only, and so forth. Some research also suggests misconceptions of physics that occur in elementary school teacher (Baser 2006; pujayanto, 2011), a high school teacher and Madrasah Aliyah (Wahyudi, 2013; Holomoan, 2008), and the college student (Kabaca, et al, 2011; Saputri, 2012; Taufiq 2012; Suastika 2015; Saputri 2015). Researchers trying to uncover and identify the concepts of physics common misconceptions and apply specific learning strategies in an attempt to remediate these misconceptions.

Wandersee, Mintzes, and Novak, 1994 (in Suparno, 2013) states that misconceptions or alternative concepts occur in all areas of physics. Of the 700 studies on misconceptions, there are 300 who studied in the field of mechanics, 159 on electricity, 70 of thermal, optical and material properties, 35 of earth and space as well as 10 studies on modern physics. Misconceptions in the field of mechanics widely studied because it is the main starting materials and the high schools and as well as in the first years of college. Misconceptions of college student prospective teacher of will have an impact on the 'contagion' misconceptions to their students when they become teachers later.

The attitude of the students towards learning physics can also affect the performance of students in solving physics problems. Olusola, et al, (2012) found that the cause of the poor performance of students in learning physics is due to lack of information, lack of confidence, inability to solve problems in physics correctly using the appropriate formula, and unable to see the relevance of physics to everyday activities in society. Likewise, Kaya, et al, (2011) states that one of the factors that influence negatively students' attitudes toward learning physics is the study of physics held in the classroom based only on theory. Though the invention is much better to learn by associating concepts of physics to students' daily lives. Thus, the attitude of students towards learning physics of which is influenced by the presentation of learning by educators and learners are actively involved in the learning process.

This study aimed to investigate the understanding of physics concepts and misconceptions that occur in the first year students in college and know the attitude of the students towards learning physics. The research question in this study are: (1) How can understanding the concept of ‘force’ in the first year students who have taken the course of General Physics? (2) What ‘force’ concept

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into the misconceptions by the students? (3) What is the attitude of the students towards learning physics?

THEORETICAL FRAMEWORK

Some definitions misconception is described by experts, that misconception is defined as an interpretation of the concepts in an unacceptable statement (Novak, in Suparno, 2013). Meanwhile, Fowler (in Suparno, 2013) explains the misconceptions in more detail as the understanding is not accurate concept, the use of the wrong concept, classification examples wrong, chaos of different concepts, and the hierarchical relationship concepts that are not correct. In physics, misconceptions can be interpreted as the use of a physics concept that is incompatible with the concept described by experts or scientists of physics that have been scientifically acceptable.

Misconceptions or errors understand physics concepts, generally occurs when learners construct knowledge and understanding before following the learning process of physics formally in educational institutions, such as the concept of ‘weight’, ‘heat’ and ‘effort’, they've got the concept in daily activities, different with concepts in physics that they receive at the institution. The initial concept or preconceptions they bring sometimes at odds with the concept brought by experts or scientists. Error understand the concept of what is called misconceptions or alternative concepts.

Howard Gardner (in Carin, 1997) states that misconception or concepts naive survive because of early education teachers do not give students the chance to retest the misconception that obtained by the students at an early age. Misconceptions and naive theory may persist even after students successfully complete courses in a school. For example; of everyday students see that ‘the rock falling faster than the the leaves’. If the students are not learning in school to experience things that are contrary to their naïve theory that, ie for example; leaves and stones fell together in vacuum space, the naive theory or misconceptions students will be resistant or stick to the higher education level.

Attitudes Toward Learning Physics

The term "attitude" is defined as an evaluation of positive or negative affect on people, objects, events, activities, or ideas in an environment of individuals that affect the way an individual was in response to an external stimulus (Zimbardo and Gerrig, 1999, in Arce, et al, 2014). Attitude is also associated with the management of emotions that occur during the learning process, and was instrumental in directing human behavior. Attitude is happening is part of a system of values and beliefs, whether positive or negative, the attitudes will affect the learning process directly and affect the future lives of individuals (Seferoglu 2004 ;. Sunbul et al, 2004; in Kaya, et al, 2011), The attitude of the students towards learning physics will affect the student's behavior in response to the stimulus in the learning process of physics. Educators need to know the attitude of students towards learning physics, foster a positive attitude and reduces the negative attitude to cultivate good learning behavior.

METHOD

This study is a preliminary phase of development research learning materials. At this preliminary phase conducted survey research on understanding the concepts of physics and physics student attitudes toward learning to know more in-depth the problem of understanding the concepts and misconceptions students, and is the basis for the phase of design or prototype in the next. Plomp, et al, (2013) states that usually each research design can be used for realizing more than one research function, such as survey, case studies, experiments, and so forth.

The sample consisted of 43 students of physics education at the State University of Padang, which has been taking courses in General Physics. Data collection techniques using non-test techniques and tests. The research instrument consists of three types: (1) test FCI (Force Concept Inventory); is a standardized test consisting of 30 multiple-choice test items to investigate the students understanding of the basic concepts of force. FCI has been translated into 10 languages (including Indonesian) and has been used widely in the level of secondary schools and universities in various countries. Concepts in FCI includes material kinematics, Newton's first law, Newton’s second law, Newton's third law, the resultant force, as well as other types of forces. (2) Test standard attitude CLASS (Colorado Science Learning Attitude Survey) to measure attitudes and beliefs of students, consisting of 42 statements about the attitude of students toward learning physics. Statements in CLASS is equipped with a 1-5 Likert scale ranging from Strongly Disagree (SDA) to Strongly Agree (SA), (3) Open quessionaire about the reasons for choosing an answer FCI, and the equations used; to know in depth understanding of the concepts and misconceptions students. Data analysis techniques menggunaakan t test, percentages and descriptivelly analysis.

RESULT AND DISCUSSION

There are three parts of the results of this study, namely (1) of the t test FCI data is acquired understanding of the concepts of physics students about the style is very low (≤ 50%) and the majority of students also had misconceptions. (2) The misconception concept of force occurs in a vertical motion, horizontal motion and circular motion. It is also revealed from the questionnaire answers students. Below are examples of student answers to the questions FCI and questionnaires about the reason of their answers.

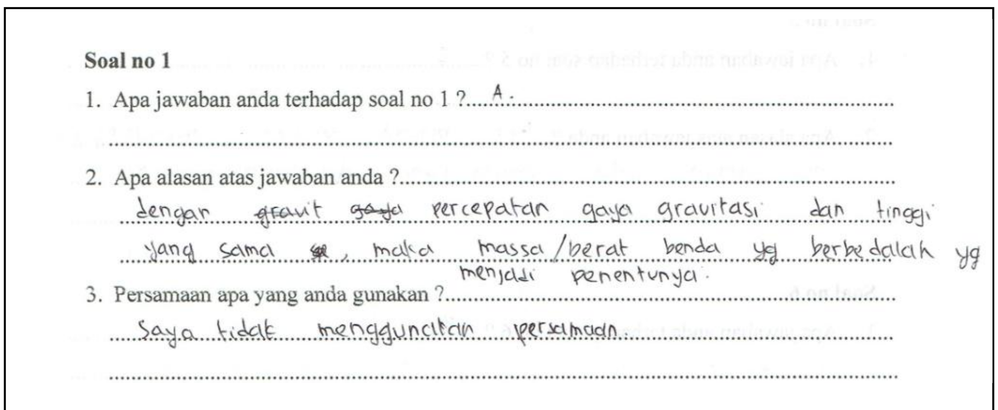
Problem 1. Two metal balls are the same size but one weighs twice as much as the other. The balls are dropped from the roof of a single story building at the same instant of time. The time it takes the balls to reach the ground below will be:
(A) about half as long for the heavier ball as for the lighter one.
(B) about half as long for the lighter ball as for the heavier one.
(C) about the same for both balls.
(D) considerably less for the heavier ball, but not necessarily half as long.
(E) considerably less for the lighter ball, but not necessarily half as long.

Recapitulation Student Answers	A	B	C	D	E
	39 %	14 %	**12 %**	33%	2 %

Only 12% of students answered correctly (C). Meanwhile, 39% of students answered A and 33% of students answered D. Answers A and D, be elected the students because it fits with intuition or their 'common sense'. This is a common misconception, both among high school students and college students in the case of vertical motion.

This is reinforced by student questionnaire answers about reason the student answers and equations they use. From 9 respondents, obtained to problem 1, 22% of students (2 students) answered correctly. One person can not give a reason, this indicates that the student does not know the concept of (guess). While 78% of students answered incorrectly, but on the grounds of their answers indicated their misconceptions. They answered based on intuition rather than on a true scientific concept. Students also can not associate the equations of physics to concepts that explain these equations. (See Figure 1.).

In accordance with Carin (1997) which states that the topic of science 'motion of objects', naive theory is: 'heavier objects fall faster than lighter objects'. While the scientific explanation: 'acceleration proportional to the force'. Theory naive or student misconceptions are not easily changed, except with meaningful learning through the process of conceptual change. In the process of conceptual change, students must recognize that their personal theories themselves are in conflict with the accepted scientific view. They need reassurance that their theories are themselves inadequate, incomplete, or inconsistent with the experimental evidence.


Soal no 1

1. Apa jawaban anda terhadap soal no 1 ? A
2. Apa alasan atas jawaban anda ? dengan ~~gravit~~ ~~gaya~~ percepatan gaya gravitasi dan tinggi yang sama, maka massa / berat benda yg berbedalah yg menjadi penentunya.
3. Persamaan apa yang anda gunakan ? Saya tidak menggunakan persamaan.

1. What is the answer to problem 1? (A)
2. What are the reasons for your answer? (because acceleration of gravity and the same height, then the decisive is the mass and weight of the object.)
3. Equation what you use? (I don't use equation)

(a)

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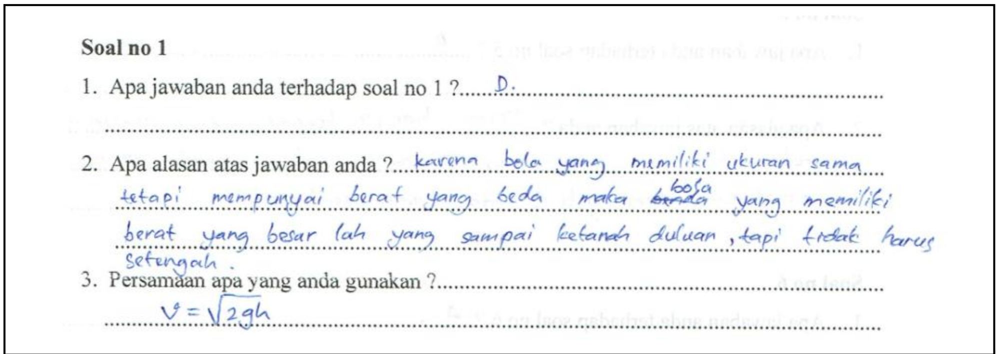


Soal no 1

1. Apa jawaban anda terhadap soal no 1 ?......D.
2. Apa alasan atas jawaban anda ?... karena bola yang memiliki ukuran sama tetapi mempunyai berat yang beda maka ~~benda~~ bola yang memiliki berat yang besar lah yang sampai ketanah duluan, tapi tidak harus setengah.
3. Persamaan apa yang anda gunakan ?......

$v = \sqrt{2gh}$

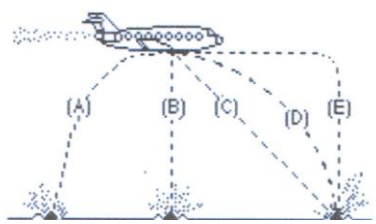
1. What is the answer to problem 1? (D)
2. What are the reasons for your answer? (because the balls are the same size but have different weight, then the ball has a great weight that hit the ground first, but not necessarily half)
3. Equation what you use? (v = √2gh)

(b)

Figure 1. The reason the students answered (a) A and (b) D.
Both indicate a misconception

Below is the answer, and the reason for students to problem 14, which also showed a misconception.

Problem 14. A bowling ball accidentally falls out of the cargo bay of an airliner as it flies along in a horizontal direction. As observed by a person standing on the ground and viewing the plane as in the figure at right, which path would the bowling ball most closely follow after leaving the airplane?



Recapitulation Student Answers	A	B	C	D	E
	70 %	19 %	0 %	**12%**	0 %

As many as 70% of students answered (A). The answer is the student intuition or 'common sense'. Only 12% of students answered correctly (D). No student answered (C) and (E) because the choice is unreasonable. Misconception look of the reasons the student answers, as shown in Figure 2.

Soal no 14

1. Apa jawaban anda terhadap soal no 14 ? A
2. Apa alasan atas jawaban anda ? Ketika bola jatuh, ~~kec nya tsb searah~~ ke kec. mendatarnya tdk ada Sedangkan kec. pesawat sangat besar Sehingga bola akan jatuh jauh dari pesawat / ditinggalkan pesawat.

1. What is the answer to problem 14? (A)
2. What are the reasons for your answer? (When the bowling ball falls, no velocity horizontal direction. Meanwhile, the airplane speed is very large, so the bowling ball will fall away abandoned airplane.

(a)

(a)

Soal no 14

1. Apa jawaban anda terhadap soal no 14 ? (A)
2. Apa alasan atas jawaban anda ? Saat bola bowling jatuh dari kapal terbang yg sedang melaju, maka bola akan jatuh bebas, pada saat jatuh permukaan bola bergesekan dg udara, sehingg pada saat jatuh, bola tidak jatuh tepat di bawah pesawat, melainkan sedikit ke belakang

1. What is the answer to problem 14? (A)
2. What are the reasons for your answer? (when the bowling ball falling from a plane that was speeding, then the ball will be in free fall. At the time of tumbling, rubbing with air ball, so the ball does not fall right down, but slightly to the back.

(b)

Figure 2. Answer two students who show their misconception on the problem 14: (a) the first student, (b) a second student

Based on analysis of 30 questions FCI, the students have problems in understanding the concept, including the problem of misconception, namely on the concept: (1) the force on the vertical motion, (2) force in circular motion, (3) the resultant force and the velocity vector, (4) force on a parabolic motion, (5) the force on the simple pendulum motion.

The results of the third part of this study were obtained from the survey of student attitudes toward learning physics (CLASS). The analysis showed that the attitude of students towards studying physics is still not good. Only 51% of students who had the pleasure of solving physics. As many as 81% find it difficult to resolve the problems of physics concepts although they have understood the topic in question in the matter. As many as 47% of students felt that the equations of physics do not support their ideas in understanding concepts of physics equations required only for a matter of course.

The results of this preliminary reseach used as a reference in designing learning materials based cognitive conflict in order to overcome various obstacles students in understanding the concepts of physics and remediate student misconceptions. Learning materials designed will give conflicting phenomenon in student thinking and guide students in finding the correct concept through physics equations related to the phenomenon. Students will be encouraged to think deeply find the correct concept in accordance with the scientific concept put forward by the experts. Learning materials is also designed to enable students and improve the performance of students in learning, particularly in finding concepts of physics are correct and remediate misconceptions physics students.

CONCLUSION

The students understanding of the concept of force is very low (≤ 50%). The majority of college students have misconceptions about force, especially the force on the vertical motion, circular motion, parabolic/projectile motion and a simple pendulum motion. Based on the analysis of student attitudes, found that; the students find it difficult to resolve the problems of physics concepts although they have understood the topic in question. Students also felt that the equations of physics do not support their ideas in understanding concepts of physics equations required only for a matter of course. Need designed cognitive conflict based learning materials to solve the problems of understanding of the concept and remediate misconceptions students, through a design or development research.

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THE ANALYSIS OF PROBLEM SOLVING ABILITY BY IMPLEMENT PROBLEM SOLVING STRATEGY IN MATHEMATICS LEARNING AT CLASS VIII SMP AL-AZHAR SYIFA BUDI PEKANBARU

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Abstract

This research is a pre-experimental research with the static group comparison study design, that aims to comparethe mathematical problem solving ability of students by using problem-solving strategyandthe students who did not use theproblem-solving strategy. This research involved experimental class that consists of 24 students and control class that consists of 20 students. The test score of students' mathematical problem solving ability is the data that used to test hypothesis of the research. Based on the test score, obtained the average score of mathematical problem solving ability of students in experimental class was 3,19 and the average score of mathematical problem solving ability of students in control class was 2,02. From the Mann-Withney test, obtained significance score was 0,00002 (less than $\alpha = 0{,}05$), *it is mean that* H_0 *has rejected and* H_1 *has accepted. So, itcan be conclude that the mathematical problem solving ability of students by using problem-solving strategies is better thanthe mathematical problem solving abilityof students who did not use at class VIII SMP Al-Azhar Syifa Budi Pekanbaru school year 2015/2016.*

Keywords:*Problem-Solving Strategy, Mathematical Problem Solving Ability, Pre-experimental Research*

INTRODUCTION

According to ministerial regulation No. 58 on2014, one of the goals of mathematicslearning in junior and senior highschoolwas the students have the ability to use reasoning on the nature, perform well in streamlining mathematical manipulations, as well as analyzing the components in the context of problem solving in mathematics and outside mathematics (real life, science and technology). This purpose is accordance with one of the goals of mathematics learning are formulated by the National Council of Teachers of Mathematics (NCTM) is a problem-solving ability (NCTM, 2000).Mathematical Problem Solving Ability (MPSA) that obtained in mathematics learning can be transferred for use in solving another problem or make a decision. Such capabilities require a mindset that involves critical thinking, systematic, logical and creative. Furthermore, Holmes (in Sri Wardhani, et al., 2010) also said that people who are skilled in solving mathematical problems, will be able to race with the necessities of life, become workers who are more productive and understand the complex issues related to the global community in these twenty-one century. Based on the above, it is clear that the MPSA is must be owned by every generation through learning of mathematics.

One of international study that assessMPSA is the Programme for International Student Assessment (PISA). PISA is an international study in order to assessment of learning outcomes that one of it is objectives to test the mathematical literacy of students aged 15 years.

PISAtransformmathematical literacy principles into three components, components of content, process and context. Component of processes in PISA studies interpreted as things or steps someone to solve a problem in a particular situation or context by using mathematics as a tool so that the problem can be resolved. Therefore, the questions that tested by PISA is the problem-solving questions. PISA is conducted every three years and Indonesia began participating since 2000. Table 1 below shows the ranking of Indonesia in mathematics from 2000 to 2012.

Table 1 The rangking and scores of Indonesia in mathematics based on PISA survey

Years	**The average scores**		**Indonesia Rank**	**Number of Participant**
	Indonesia	**Internasional**		
2000	367	500	39	41
2003	360	500	38	40
2006	391	500	50	57
2009	371	500	61	65
2012	375	500	64	65

Source: www.litbang.kemendikbud.go.id

Table 1 shows that the average scores of students in Indonesia under the average scores internationally. The questions that tested by PISA is the problem solving questions, so that the results of PISA survey shows that the MPSA of students in Indonesia is still very low.

The fact that the MPSA of students in Indonesia is still lowalso evident from the results of the national exams (UN) that implemented by the Ministry of Education and Culture. Based on lattice of math national exam on 2014/2015 is known that 84% indicators of the questions requires students to have MPSA (BSNP, 2014). On 2015, the average scores of student's national exam scores in SMP / MTs decreased by 4.73 from the previous year from 61.00 into 56.27 (Kemendikbud, 2015). Based on these data, it can be construed that a decrease in the average national exam for mathematics courses are caused by the lack of students' skills in solve the problem solving question.

Riau Province as one of the provinces in Indonesia also experienced a decrease in the average scores of the math national exam. On 2014, the average scores of math national exam in junior high school students at Riau Provinces was 69.2 and on 2015 the average scores ofmath national exam in junior high school students at Riau Provinces is 62.39 (Kemendikbud, 2015). Based on these facts, it can be concluded that the lack of MPSAof Junior High School student (SMP) in Riau Provinces that requires a serious treatment.One of the junior high school has decreased the average scores of the math national exam is SMP Al-Azhar Syifa BudiPekanbaru. Based on data from this school, it is known that the average scores of math national examon 2015 was 74.87 and on 2014 was 76.93. The data show that the average scores of math national exam at SMP Al-AzharSyifaPekanbaru Budi declined by 2.06.From the facts above, it can be concluded that one of the goals of mathematics learning namely mathematical problem solving ability has not been achieved well by students in Indonesia, especially at SMP Al-AzharSyifa Budi Pekanbaru.

The process of learning mathematics in schools is very influent the development of students' MPSA. Therefore, researcher interested in conducting observations at SMP Al-Azhar Syifa BudiPekanbaru.Based on the observation, it appears that the process of learning mathematics was not facilitate students to develop their mathematical problem-solving ability. Learning activities that require MPSA of students done only to provide materials and examples of problem solving without teaching studentshow to be able to solve the problem step by step. Problem solving is a skill that needs to be taught and mathematics teachers should make an effort for it (Sri Wardhani, et al., 2010).Furthermore, the researcher also conducted interviews with teacherand students. Based on the interview that researcher do with the teacher, obtained information that students have difficulty to completing a problem because the students are not able to understand the interrelationships between concepts and problems. Based on interview between researcher and students, obtained information that students difficult to solve the problems because the students do not understand the steps that must be done in solve the problems.

Mathematical problem solving requires a high level of creativity because the procedures to solve the problems arenot immediately visible, but requires a strategy to solve them (Lenchnner in Sri Wardhani, et al., 2010). According toPolya (2014), the general problem-solving strategy consists of four steps, understanding the problem, devise a plan, carry out the plan, and look back.Understanding the problem is a step that helps students to explore the problem situation, selecting the facts, determine the relationships between facts and then formulate the questions. Once students understand the problem, they are directed to devise a planfor solve it. In this step, requires a specific strategy. One of the specific strategies that can be used is to create diagrams / drawings picture. This stategy associated with making sketches or images to make the students understand the problem and facilitate students to get a general solution. With this strategy, things are unknown not only conceivable in the brain, but also can be poured on the paper.

After understanding the problems, the next step is carry out the plan. This step necessary calculations, algebraic manipulation, making explanations, and arguments (Sumardyonno, 2011). Therefore, to find the right solution, a plan that has been made in the second step should be implemented carefully. The last step in a problem solving strategy is loock back. Students are directed to review the implementation of the plan, the thing to do is to re-examine the results of calculations performed and then check the validity of the arguments on each step and make the appropriate conclusions (Sri Wardhani, et al., 2010).

The foursteps of problemsolving strategies will teach students to be able to make a good plan insolving problems, execute plans and familiarize the students to reflect on the results of problem solving so they produce the appropriate conclusions. The implementation of problem-solving strategies continuously in maths learning will teach students to be able to resolve the issue properly. Based on the analysis of the above problems, the researcher found the existence of problems in mathematics learning that need to be repaired. The problem is the improvement of mathematics learning process in teaching mathematical problem solving ability.

One of the learning materialthat demanding MPSA of students is the Pythagorean Theorem. This material is linked to the Basic Competency (BC) 4.5 “Using the Pythagorean Theorem to solve various problems”. Based on the above, the researcher will try to apply Polya problem-solving strategies with specific strategies create anpicture on basic competence 4.5. Researcheralso will analyze which one is better between theMPSA of students with problem-solving strategies or theMPSA of studentswho did not use problem-solving strategies at class VIII SMP Al-Azhar Syifa BudiPekanbaru. Therefore, this study involved two groups, students who got the mathematics learning by problem-solving strategies, and students who received the conventional mathematical learning. Thus, the study entitled "The Analysis of Problem Solving Abilityby Implement Problem Solving Strategy in Mathematics Learning at Class VIII SMP Al-Azhar Syifa Budi Pekanbaru".

RESEARCH METHOD

This study is a pre-experimental with The Static Group Comparison Design (Cottrel and James, 2011). This design involves two classes, the experimental class and the control class. The experimental class and control clas as the sample of this reseach were taken from the population (all student of class VIII at SMP Al-Azhar Syifa Budi Pekanbaru). The sample was selected by using random sampling techniques. The experimental class get the learning with implementation ofproblemsolvingstrategies in mathematics (X_1) atBC 4.5 "Using the Pythagorean Theorem to solve problems", while the control group received conventional treatment of learning.The independent variables in this study are problem-solving strategies in mathematics learning (X_1) and the dependent variable in this study is a mathematical problem solving ability (MPSA). After the treatment is given, the control and experimental classes were given the postesabout mathematical problem solving ability related to BC 4.5.

The data that analyzed in this research is quantitative data from the results of MPSA test. Data analysis process begins with testing the statistical requirements thatnecessary as a base in order to test the hypothesis. The statistical requirements are the test for normalityand homogeneity of MPSA test score.If the normality test is concluded that the data are not normally distributed, then the hypothesis test will be used non-parametric Mann-Whitney test otherwisethe hypothesis test will be used parametric Independent Sample T Test.

RESEARCH FINDING

The research findingfrom MPSA test scores were analyzed to test which one is better between the mathematical problem solving ability of students by implement problem-solving strategies or the students who did not use at class VIII SMP Al-Azhar Syifa BudiPekanbaru 2015/2016. The data analysis was initiated to test the statistical prerequisites are required as the basis of hypothesis testing, test for normality and homogeneity. The process of data analysis was performed with SPSS version 18 for Windows. Normality test is performed to determine whether the data ofproblem-solving abilities of students normally distributed or not. From normality test obtained thesignificance scores *(sig.)*of the experimental class is 0,012 and thesignificance scores *(sig.)*of the control class is 0,014. This result show that the significance score from both of the classes is less thanα = 0,05. It is mean that, the data of students' MPSA test in experiment and control classesnotnormally distributed. Therefore, to test the hypothesis of this reseacrh used non-parametric Mann-Whitney test.The hypothesis is:

H_0: The average score of mathematical problem solving ability for student that using problem solving strategy isless than the average score of mathematical problem solving ability for student that didn't use problem solving strategy
H_1: The average score of mathematical problem solving ability for student that using problem solving strategy isbetter than the average score of mathematical problem solving ability for student that didn't use problem solving strategy

From the Mann-Whitney test, reseacherfind the significance scores (sig.) less than α = 0.05 (0,00002).It is meansthat the mathematical problem solving ability of student by implement problem solving strategy is better than the students who didn't use.

In this research, the indicator of MPSA used (1) understanding the problem; (2) devise a plan; (3) carry out the plan; and (4) look back (Polya, 1995). Table 5 below presents a more detailed explanation of the students' test scores based on four MPSA indicators.

Table 2 MPSA test scores of students at experiment and control classes

No	Indicator	The average scores		Difference
		Experiment	Control	
1	Understanding the problem	3,56	1,36	2,20
2	Devise a plan	2,06	1,40	0,66
3	Carry out the plan	3,77	3,08	0,69
4	Look back	3,40	1,28	2,12

Understanding the problem is the first step that must be done by students in the problem solving process. Students who understand the problem is that the student can choose the facts, determine relationships between facts and formulate questions matter.Based on Table 2, showed that the average score of the experimental class on the first indicator "understand the problem"is better than the control class (3.56> 1.36) with a difference 2.20. This shows that the application of problem-solving strategy have a positive impact on the ability of students to understand the problem. Students are able to understand the problem properly will be able to make good problem solving plan anyway.In devise a plan steps required specific strategies. Specific strategies referred to in this study isdraw a picture strategy. This specific strategy associated with making sketches or pictures to make the students understand the problem and facilitate students to get a general overview of completion. The implementation of this specific strategy, give a positive impact on the ability to plan problem-solving. This is evident from the average score for problem-solving plan indicators. The experimental class are better than the control class (2.06>1.40) with a difference0.66. These research findings are also consistent with previous research conducted by Sawati (2010) which concluded that the application of problem-solving strategywith specific strategy draw a picture positive effect on ability to solveproblems.

Third step in problem solving is to implement a plan. In this step, the plan that has been made previously had to be done carefully so as to produce the right solution. Based on Table 2, the average score of the experimental class students on the indicator carry out the plan is better than the average score of control class (3.77>3.08) with a difference 0.69. This indicates that the application of problem-solving strategy in mathematics learning can teach students to perform plan better than the students who received conventional learning.The last step that must be done to solve the problem is review the implementation of the plan. In this step, students are directed to re-examine the results of the calculations he had done, check the validity of the arguments on each steps and make their conclusions in troubleshooting. From Table 2 shows that the average score of the experimental class on the indicator review the troubleshooting plan is also better than the control class (3.40 > 1.28) with a difference 2.12. That is, the application of problem-solving strategy in mathematics learning can teach students to conduct a review of the implementation of the plan of solving the problem better than students who received conventional learning.

Based on the above, the researcher found that for each indicator of problem solving strategy, the average scores of students in the experimental class is better than the average scores of students in the control class. This shows that, the application of problem-solving strategy in mathematics learning is a good contribution to the students' skills in understanding the problem, devise a plan, carry out the plan and look back. Students' ability to perform four steps is referred as mathematical problem solving ability.

CONCLUSION

Based on the results finding and discussion that has been presented in the previous section, we can conclude that the mathematical problem solving ability of students by using problem-solving strategies is better than the mathematical problem solving ability of students who did not use at class VIII SMP Al-Azhar Syifa Budi Pekanbaru school year 2015/2016.

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DEVELOPMENT OF GUIDED DISCOVERY-BASED MATHEMATICS LEARNING MATERIALFOR GRADE XI-IPA OF SENIOR HIGH SCHOOL

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Abstract

Learning material is an important factor that can influnce the quality of Learning. A good learning set should be able to make the students find their own concepts.In this case, it is required to develop mathematics learning materialwhich can fasilitate the students in finding the concept. In this research, it has been developed guided discovery-based mathematics learning material that is expected to achieve that goal. The purpose of this reserch was to poduce a valid, practical and effective guided discovery-based mathematics learning material. This research uses Plomp model which is proposed three stages of developmentc: preliminary research, development or prototyping phase and assessment phase. The learning materials developed were a lesson plan dan student worksheet. Data validity analysis showed that guided discovery-based mathematics learning material resulting in extremely valid category because the learning material had a good validity both the content and construction side.

Keywords: mathematics learning material, guided discovery, Plomp model

INTRODUCTION

The school is one of formal educational institutions that carry out a series of activities that the learning process has been set in accordance with the applicable curriculum. In this case, the school has a goal of producing a human who has the intellectual level and specific skills, as well as a sublime act to deal with the existing problems in everyday life, so that it can cope with the demands of more advanced age and growing. Learning is central to the activities carried out in schools. Learning is inseparable from learning device. In order to conduct learning activities that facilitate students to develop the ability to think logically, critically and creatively, teachers are expected to make a lesson plan, one of them by creating a learning device.

Learning materail is any equipment prepared, drafted, and is used by teachers so that the implementation and evaluation of learning takes place effectively and systematically. Ibrahim Trianto [1] says that " Perangkat yang digunakan dalam proses pembelajaran disebut dengan perangkat pembelajaran ". According Darmojo and Kaligis [2] that " Perangkat pembelajaran yang baik harus dapat memotivasi siswa untuk terlibat dalam kegiatan pembelajaran ". Therefore, teachers are required able to develop their own learning tools tailored to the curriculum, materials, and characteristics of students. The availability of quality learning tools is one factor that can support the learning process goes well and can improve the quality of education. Through learning tools teachers can more easily implement the learning process.

But in fact, the teacher has not developed a learning device optimally. Learning tool, especially lesson plans and worksheets, which are widely used by teachers today still can not motivate students to actively participate in learning activities. Some teachers still consider RPP are only made as fittings administration, whereas the RPP is a reference teachers to perform the learning activities to be more focused. RPP used yet included learning activities that require active participation of students. The role of teachers and students in learning activities are also not described in detail on the RPP. In addition, the LKS as one of the limited availability of teaching materials. LKS commonly used by teachers in the form of worksheets that are developed and sold by a particular publisher. LKS of publishers usually contains a summary of the material in the form of formulas and practice questions, less guiding students to be actively involved in the process of getting the concept or formula is thus less able to understand the material completely. Sometimes the use of worksheets in the learning activities are rarely carried out. Whereas the use of LKS in learning activities can enable students and easier for students to understand the material given.

Based on interviews with teachers at private high school Pembda 1 Gunungsitoli, math learning progress is quite good. Teachers have done their job well. However, the process of learning that takes place is not optimal, student learning is still quite passive. In learning activities in class teachers teach the material directly without involving the students to find their own formulas and properties that exist on the matter. So that students tend to memorize formulas and properties exist without knowing how to get it. As a result, the work on the problems given by teachers, students difficult to determine which formula to use. It is also because the learning device used is less facilitating students to learn actively find their own concept of matter. Teachers often use traditional methods consist of lectures, giving examples, and exercises more effective because according to the allocation of time.

Learning math is a good should have a variety of learning approaches that vary according to the material being taught. But the fact almost all of the material submitted by the method of mathematical monotony that is delivering the material, debriefing and provide training. Students are less involved actively and sincerely in learning activities. Students not involved independently in finding its own concept of the material learned. Teachers often dominated learning by giving lectures and the students listen to what the teacher then direct it down in a notebook. As a result of student activity is reduced, so that students can be hard to understand the material being taught. Sometimes not all the students listen carefully, there are some students who busy themselves and not listen to the teacher's explanation.

From interviews with several students in private high school Pembda 1 Gunungsitoli known that some students have difficulties in understanding mathematical concepts because learning is dominated by teachers. This causes students to become lazy and less motivated to learn mathematics. Furthermore, during a lesson, some students feel bored and sleepy in class. Most of the students there is a lack of focus and tend to speak with his friend when learning takes place. In fact, sometimes practice questions provided by the teacher not all students are able to finish. So we can conclude that, the learning process has not been implemented optimally. So this has an impact on student learning outcomes. This looks poor student learning outcomes taken from one of the schools that were observed, namely SMA Private Pembda 1 Gunungsitoli in class XI-IPA where the percentage of completeness of students at the two final exams 2014/2015 school year as many as 14 students from 33 students or by 42, 42%.

The above fact requires attention and kreaktifitas teachers to construct a learning device. The development of learning tools should be adapted to the characteristics of the students, so it requires the right approach in developing a learning device. In the implementation of existing learning should be organized in accordance with standard processes such as holding interactive learning activities, fun, challenging, and especially can motivate students to participate actively. Active student involvement can encourage them to find patterns, rules or formulas that will provide a new experience to the students.

Guided discovery approach considered appropriate to develop a learning tool because it can make students active and guided in learning. In the process of guided discovery, students receive guidance from teachers since the beginning of learning so that they are directed so that the implementation process of learning as well as an achievable goal can be implemented optimally. How far students are guided depends on its ability and the material being studied. Teachers act as mentors who help students to use any ideas, concepts and skills they have learned previously to gain new knowledge.

Burner [4] says that "Learning is the search for knowledge discovery actively by students. Student starts to look for solutions and the accompanying knowledge, generate knowledge that is really meaningful. "According Suherman, et al [5] says that" Said invention as a method of teaching is the discovery made by the students. In this study find yourself something new. This does not mean that it is the discovery of a completely new because it is already known by others. "According to Suprihatiningrum [6] states that" guided discovery learning, students discover something new with the help/guidance of teachers ". Further Markaban [7] says "Model guided discovery can be held individually or in groups. This model is very useful for mathematics courses in accordance with the mathematical characteristics ". It can be concluded guided discovery is a learning process that leads students participate actively find their own new knowledge, while teachers act more as facilitators and mentors for students either individually or in groups.

There are also step-by-step model of guided discovery to be done by the teacher according to Markaban [8]: (1) Formulate the problem that will be given to students with the data sufficiently, the formulation must be clear, avoid statements that led to the wrong so that the direction the student is not wrong ; (2) From the data provided by the teacher, students compile, process, organize, and analyze data. Guidance teachers can be given in the form of direct questions or can be poured inside LKS. (3) The students prepare a conjecture (forecasts) on the results of the analysis done. (4) If deemed necessary, a conjecture that students have made the above is checked by the teacher. It is important to convince the truth forecasts of students, so that will be the direction to be achieved. (5) Where have gained certainty about the truth of the conjecture, the conjecture verbalization should be submitted also to the students to put them together. (6) After the students find what they need, teachers should provide exercises or additional questions to examine whether the findings were true.

Based on the above, researchers will conduct development research-based math learning tools to support the smooth guided discovery learning activities and facilitate students' understanding of the material, especially for students of class XI-IPA SMA. The learning material developed include a lesson plan (RPP) and student activity sheets (LKS) is valid, practical and effective in use.

RESEARCH METHODS

This study was designed using a model development research denagn Plomp. In development is done using the three stages on the model Plomp. The first stage is the preliminary research, development or prototyping phase and the assessment phase [9]. In the preliminary research conducted needs analysis, curriculum analysis, analysis of Siwa and analysis concepts. In the first phase or phases of the initial investigation conducted a needs analysis, curriculum analysis, analysis of student and concept analysis. At this stage of development or prototyping phase consists of the prototype 1, which is the result of product design; 2 that the revised prototype product after conducting self evaluation and expert review; 3 that the revised prototype product after melaksanakanone to one; 4 prototype, namely the revision of the product after melaksanakansmall group. Furthermore, at this stage of the assessment phase dilakukanfield test to look at the practicalities and effectiveness of learning.

The instrument used in this study include interview, self evaluation sheets, sheets validation, observation sheets keterlaksanaan RPP, questionnaire responses teacher, student questionnaire responses, observation sheet student activity and achievement test. Before use, each instrument is validated by experts. Validation of instruments validated by 3 people validator. The instrument has a valid used in the study.

The data were analyzed according to the type of data. The qualitative data were analyzed by means of qualitative and quantitative data were analyzed and categorized so that quantitative conclusions can be drawn.

RESULTS AND DISCUSSION

A. Preliminary Research Results

At this stage, identification or analysis required for the development of devices based on guided discovery learning of mathematics. This phase is done by analyzing the objectives within the constraints of the subject matter that will be developed.

1. Analysis of needs

The collection of information is done by interviewing a mathematics teacher in SMAs Pembda 1 Gunungsitoli and observation implementation of mathematics learning in the classroom and the learning device usage. Based on interviews with information obtained mathematics teacher of teachers are more likely to use conventional learning models because it is considered more effective in the use of time; the ability of students varied so that the necessary teaching materials suitable for all students and teachers do not use the worksheets as teaching materials in the learning process because it is based on past experience which is only a summary of the material and a collection of matter. The results obtained by the observation that mathematical learning process in the classroom can not be said to be optimal. Learning is still focused on the teacher, students are listening to the teacher's explanations, noting what was written on the board and do the exercise in accordance with that given by the teacher. Teaching materials used by teachers only mathematics textbooks.

Based on the needs analysis, so that the learning process involves students actively and effectively to students one alternative settlement provides worksheets as teaching materials that can motivate students to actively participate in the learning of mathematics and designing learning activities in the classroom in the form of RPP. So it is necessary the development of mathematics learning device in the form of lesson plans and worksheets to improve the quality of the learning process.

2. Analysis Curriculum

Analyzing the curriculum aims to determine whether the material taught is in conformity with the expected competencies. The analysis conducted on the curriculum standards of competence, basic competence and indicators of achievement of competencies. The results of this analysis are used to formulate indicators that guide the learning achievements in software development guided discovery-based mathematics instruction for students of class XI-IPA SMA. Analysis of the mathematics curriculum for students of class XI-IPA SMA is about the suitability of the material with guided discovery learning model. The results of the analysis of the curriculum is to be used as consideration to create teaching materials in the form of guided discovery-based worksheets. Through this LKS students can find independently understand the concepts that will be studied so the concept last long in the memory of the student. This will lead students to feel meaningful learning.

3. Analysis Students

Based on the analysis of students it can be concluded that the students have not been actively involved in learning. Many students who have not followed the lesson with the maximum, it is marked with the number of students who carry out other activities apart from learning activities. Students also found that learning implemented yet give students the opportunity to be actively involved. Other information obtained is expecting students to do math learning in groups as long as they never learn in groups. Students expect teaching materials other than textbooks and students are happy if the textbooks they use a lot of pictures and color.

4. Analysis Concept

Analysis of the concept of a phase that aims to identify, elaborate and formulate the main concepts presented in the study of mathematics. At this stage a concept associated with other concepts that form a concept map. After the analysis it can be stated that the main subject studied sukubanyak and composition function and inverse functions. Furthermore, the main material will be translated into several sub material.

B. Development Or Prototyping Phase Results

After learning indicators formulated, as well as the main concepts set out the next step is to design learning tools such as lesson plans and worksheets based on guided discovery.

1. Draft Learning Tool

a) Characteristics of RPP

RPP is designed as a guide for teachers in delivering learning materials. RPP components designed by Permendiknas 41 of 2007 on the standard process for primary and secondary education units. The learning activities are presented in RPP refers to guided discovery-based learning that is integrated in the LKS-based method of guided discovery. Presentation of RPP identity, competence standard, basic competence, indicators, learning objectives, teaching materials, allocation of time, learning resources and assessment similar to the RPP in general.

The learning model used by teachers to create an atmosphere of learning and the learning process so that students achieve basic competence or set of indicators that have been set. The learning model is the method of guided discovery. Model selection, and learning methods adapted to the circumstances of the students, as well as the characteristics of each indicator and competencies to be achieved in each lesson.

RPP-based learning activities on guided discovery method consists of preliminary activities, the core activities and cover activities described as follows: (a) Preliminary activities. Introduction is the initial activity in a meeting intended to arouse learning motivation and focus the attention of students to participate actively in the learning process. Learning activities accompanied with the allocation of time in order to facilitate the teachers implement the learning process; (B) Core Activities. Core activities is a learning process to achieve the learning objectives. At its core activities, the teacher first submitting the subject matter briefly, then students are faced with several problems related to the material being studied. The teacher asks the students to discuss in groups of students to discuss all of the information contained on the issue in the worksheet by writing the information known from verbal statements properly and write down any questions that represent the problem in order to understand the problem well. The teacher asks one group to present results of group discussion in class and other groups to respond to the explanation of group presentations. After discussion groups of students were asked to work on the problems given exercise to see the students' understanding of the material that has been studied .; (3) Closing Activities. Learning activities ended with a cover that can be done in the form of a summary or conclusions about the material that has been diperlajari, and teacher materials that will inform diperlajari at the next meeting.

b) Characteristics of LKS

Presentation of the material in the LKS follow the stages in accordance with the opinion of guided discovery markaban. The stages of guided discovery is done with the following steps. First, formulate the problem to be given to students with the data sufficiently. In this section there is a problem formulation will be given to students in the form of a concept, illustration or a problem or question. Second, from the data provided, students compile, process, organize and analyze data. Presentation given problem formulation is done so that the student can analyze invention measures what students can do to find the concept. Thirdly, the students put the conjecture / forecasts of results does. LKS is designed to facilitate students to make a conjecture / forecasts. To direct the students put the conjecture (forecast), it is provided in the form of questions that will lead. From these guiding questions, students are expected to be able to compile a conjecture (forecasts) on the results of the analysis done in the previous step. Results conjecture/forecasts of the students' answers are written in the space provided in the worksheets. Fourth, if deemed necessary, a conjecture that has been made by the students were tested by teachers. This is done to convince students forecasts. Once students find the concept is sought, the next step is to apply these concepts through practice questions. Exercises are a means for students to measure their ability to understand the material. Exercises are arranged on the level of difficulty is low, moderate to high. Exercises are given fitted with a completion for students to fill. Furthermore, to reinforce the concept of understanding, students are given assignments as a home exercise to improve its understanding of the concepts or principles that have been studied and repeat the material they have learned at home.

LKS use standard language in accordance with the enhanced spelling. LKS use simple language and communicative and in accordance with the level of understanding of high school students so that the presentation of the material in the student worksheets can be understood well. The questions on worksheets prepared with clear sentences so as to direct the students to get the expected response.

LKS-based guided discovery created using Microsoft Word 2013 on A4 size paper. Typeface used in LKS namely Comics Sans MS Jokerman and Book Antiqua font size 11pt to 16pt. The predominant color is green background and white LKS. Color green was chosen because according to a study Prof Stephanie Lichtenfeld, a psychologist from the Ludwig Maximilians University said that personal creativity can be improved simply by staring at a glance green color for 2 seconds. In addition, according Basuki in the article entitled "The meaning of color in design", the color green symbolizes growth and hope, and white symbolizes success. After learning devices (RPP and LKS) based guided discovery has already been drafted, hereinafter called the first prototype guided discovery-based mathematics learning material.

2. Self Evaluation Learning Material

Self Evaluation on the learning device implemented to see if there were any mistakes made when creating the first prototype learning device. Things that are considered in the evaluation of its own, among others, the clarity of the writing, typing errors, misuse of the term, the picture clarity and punctuation errors.

a. Self Evaluation RPP

Having conducted its own evaluation, discovered several errors contained in the prototype I RPP. Errors are then fixed.

b. Self Evaluation Worksheet

Having conducted its own evaluation, discovered several errors contained in the prototype I LKPS. Errors are then fixed.

3. Validate Learning Tool

Prototype I learning device that has already been drafted and evaluated themselves do validation. Validation was carried out by experts who are competent in their respective fields. prototype I devices based math learning guided discovery validated by five experts consisting of three experts of mathematics education, one linguist and one of the experts in educational technology.

a. Results Validation RPP

During the validation process the first prototype based RPP guided discovery, there are several revisions were carried out based on the suggestions of the validator. Having seen various inputs and suggestions from the validator, carried out repairs on the lesson plan based on advice from the validator. Once implemented improvements based on feedback from the validator, RPP validated by the validator. Overall RPP developed based on guided discovery is said to be very valid with an average of 3.27. Thus, it can be concluded that the RPP based on guided discovery to students of class XI-IPA SMA has been valid. I RPP-based prototype that has been valid guided discovery hereinafter called the prototype II RPP-based guided discovery.

b. Validation Results LKS

During the validation process the first prototype based LKS guided discovery there are some revisions were carried out based on the suggestions of the validator. Having seen various inputs and suggestions from the validator, carried out repairs on a worksheet based on advice from the validator. Once implemented improvements based on feedback from the validator, LKS validated by the validator. LKS validation results showed that to didactic aspects of validity gained an average of 3.44 with a category of very valid, content aspect with an average validity of 3.26 with very valid category, language aspects of 3.35 with the category of very valid, and presentation aspects 3 , 05 with a valid category. Overall validity LKS was 3.28 with a very valid category. It can be concluded based LKS guided discovery was valid. I LKS-based prototype that has been valid guided discovery hereinafter called the prototype II RPP-based guided discovery.

Hence it can be concluded that guided discovery-based mathematics learning material are valid both in terms of content and in terms constructs

CONCLUSIONS AND RECOMMENDATIONS

This research is a development that resulted in guided discovery-based mathematics learning material. The device in the form of lesson plans and worksheets. Based on research that has been carried out can conclude things sabagai following the results showed that the device is guided discovery-based mathematics learning material within the category of very valid both in terms of content and in terms of constructs.

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LEARNING DESIGN MULTIPLICATION USE STICK IN ELEMENTARY SCHOOL

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Abstract

Multiplication is an important matter to be taught to student. By studying multiplications students solve problem and apply it in daily life.Thisstudy aims to generate learning trajectories (LT) can help student understand the material multiplication by usingstick in elementary school student. This study will conduct in SD N 1 MegangSakti. The method of this study use design research consist of three phase ,i.e. preliminary, design experiment (pilot experiment and teaching experiment) and retrospective analysis. Subjects of this study consisted of six student of class IV SD N 1 MegangSakti in the pilot experiment phase and thirty two student of class IV SD N 1 MegangSakti in the teaching experiment phase. In the learning process of student working in group consisting of 3 student with academic ability level 1 student of high ability student one person and one person being the low ability student. The collection of data used to use the recording, LAS, Pre-test, Post-test, documentation, interviews and records during the activity. inthis study, a series of instruction are design and develop based on conjecture of learning processed and Realistic Mathematics Indonesia (PMRI) approach. In this paper discussed about teaching experiment phase.

Keywords :*Multiplication, PMRI, Stick, design research*

INTRODUCTION

Math is a subject that is feared by students, even by adults. Mathematical concepts are abstract kosep, while the mindset elementary school children (elementary school), is still at the stage of concrete operations (Muslim, 2012). Students need to understand the math pursued in accordance with the level of mental development, teachers are also expected to create a joyful learning. The subjects of mathematics, particularly Multiplication is one of the subjects taught in primary schools are often a scourge for students.Math at the elementary school level and also level selunjutnya always use multiplication and multiplication is also an early stage in the discussion fractions. In This is a challenge for teachers to be able to teach math by using methods and media are varied and it should also be true - really creative and innovative in creating learning menyenagkan. Learning mathematics in elementary school is planting stage concept, therefore students should be invited to learn the things that are concrete.

But in fact, still less creative teachers in creating lesson, students still have trouble doing oprasi multiplication in a manner provided by the teacher that is by rote and bunk down for the number of tens and hundreds. As a result, students do not understand the concept and ability to solve mathematical problems students lack.Gagne argues that students will be able to generalize when the student the concepts, rules, principles (intellectual skills) and tactics to solve the problem.Generalization is the heartbeat of mathematics(Mason, 1996) and generalizations become a very useful idea to do math (Van deWalle, 2008).

Therefore, to help students in operating the multiplication designed pembalajaran more meaningful help menamkankosep mathematics with mengunkan media and approaches. Stick game selected as the physical material that helps students to facilitate the multiplication oprasi calculates both basic and oprasioprasiperklian further multiplication.

One of the characteristics of elementary school students that love to play.Play provides valuable agreements for students in activities and explore mathematical learning(Ginsburg, Lee, & Boyd, 2008). In research to be conducted, the media serves as a stick in the context oprasi learning multiplication using research methods research design, which develops a series of activities using the approach of Realistic Mathematics Education(PMRI). In the context PMRI not have to be a real-world problem, but the bias in the form of games, the use of props, or other situations during this significant bias and bias imaginable in the minds of students (Treffers, 1987 inWijaya, 2012). Learning the game will attract students to learn mathematics and providing a strong understanding in understanding mathematical concepts at an early stage or beginners (Nuraeni, 2013). Therefore, the sticks are often used by children to play suitable for use as a starting point to facilitate learning in calculating the multiplication operation

Based on the above, this study aims to generate trajectories of students in the learning patterns of numbers using the stick in the fifth grade of elemtary school.

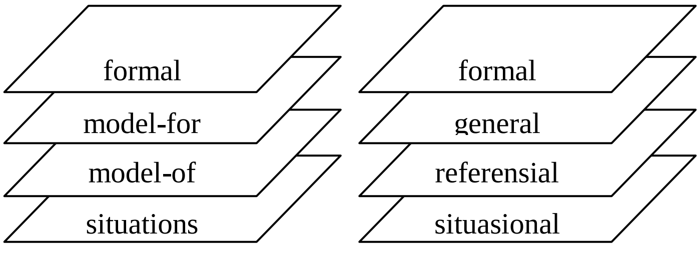
LITERATURE REVIEW

Approach to realistic mathematics Indonesia (PMRI) is an approach adopted of the*Realistic Mathematics Education* (RME), is an approach to learning mathematics developed in the Netherlands since 1970. RME rooted in a theoretical view Freudenthal that mathematics as a human activity (Gravemeijer, 1994). The statement "mathematics is a form of human activity" shows that Freudenthal did not put mathematics as a finished product, but as a form of activity or process (Wijaya, 2012). Freudenthal is a mathematical rationale corresponds to reality or reality. The word “realistik” often mischaracterized as“*real-world*”, ie the real world. According to Van den Heuvel-Panhuizen, use of the word“realistik” They do not merely indicate the existence of a connection with the real world (real-world) but rather refers to the focus of Realistic Mathematics Education in placing emphasis on the use of a situation that could be imaginedLE by students (Wijaya, 2012).

There are five characteristics PMRI according Treffers(Zulkardi, 2002)are :

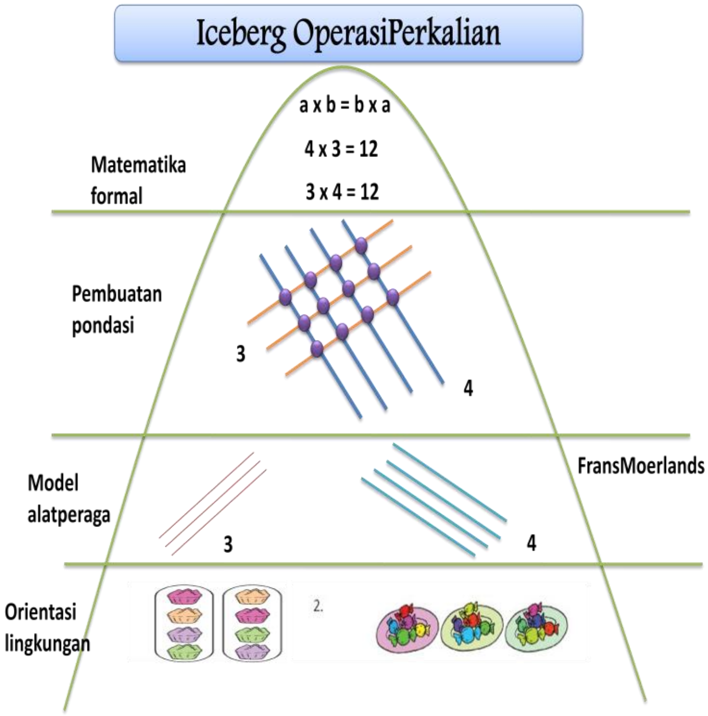
a. *Phenomenological exploration* atau*the use of context*
b. *Using models and symbols for progressive mathematization*
c. *Using student’s own contribution and production*.
d. *Interactivity*
e. *Intertwinement*

According Gravemeijer (1994), there are four kinds of learning PMRI level, namely situational, of the model, the model for, and formal which can be seen in Figure below:



Picture1.Level on Learning PMRI

Along with the above Gravemeijer opinion, FransMoerlands describe the type of realism that the idea gunungf ice (icebe) which floats on the sea.In the model of the iceberg, there are four levels of activity, namely (1) the orientation of the mathematical environment, (2) model of props, (3) construction of foundation and (4) the formal mathematics. Here's an idea of the iceberg in this study in learning multiplication is as follows:



METHOD OF THE RESEARCH

This study will use methods of design research that designs oprasi integer multiplication material in class V SD using a stick as a starting point of learning. Method design researcto be used is*type validation studie*which aims to prove the theories of learning(Nieveen, Mckenney and Van Den Akker, 2006). In this study, there are three stages to be performed repeatedly until the discovery of a new theory that a revision from the theory of learning is tested.Also, it can change and develop as long the learning process which shows that there recurring cycles or processes from the a thought experiment toward the learning experiment (instruction experiment).

Gravemeijer and Cobb (2006) states that there are three stages in the implementation of the research design. The first step is*preliminary design.* At this stage the researchers conducted a literature review of the subject matter integer multiplication operations, stick, PMRI and design research as a cornerstone in the design of learning trajectories in learning integer multiplication operation in the fifth grade elementary school. Furthermore, the researchers designed the Hypothetical Learning Trajectory (HLT) as a description of the material flow for integer multiplication operations. In the HLT developed a series of learning activities using integer multiplication operations PMRI approach contains allegations that consists from the learning objectives, learning activities and allegations of students' thinking (Simon, 1995). The allegationbe used as guidelines to anticipate emerging strategy student thinking and learning can thrive on activity.

The second stage of design experiment consisting of the pilot experiments and teaching experiment.In thethe pilot phase of the experiment, the researchers tested the T designed the small group that is involved six students. Furthermore, there were improvements in HLT used as guidelines for the next stage of teaching experiment. At this stage of teaching experiment, which has been designed and HLT previously repaired will be tested in the actual class that is the subject of research that students in grade five elementary school as much twenty-five students.A series of activities to do in class, then researchers observe and analyze things became as long the learning process.This process aims to evaluate the conjecture contained in learning activities.

The third stage is a retrospective analysis. In the this stage, the data obtained of the teaching experiments, analyzed whether or not in accordance with the conjecture that has been designed and the results will be used to develop the next learning activities.The aim of the retrospective analysis in general is to develop the Local Instructional Theory (LIT).Researchers analyzing and comparing HLT with actual learning to answer the problem in research. Data collection techniques that will be used is remakan video, observation, interviews, dokukmentasi, lapangann records and written tests were collected and analyzed retrospectively. The analysis was conducted by researchers to improve the reliability and validity.

RESULTS AND DISCUSSION

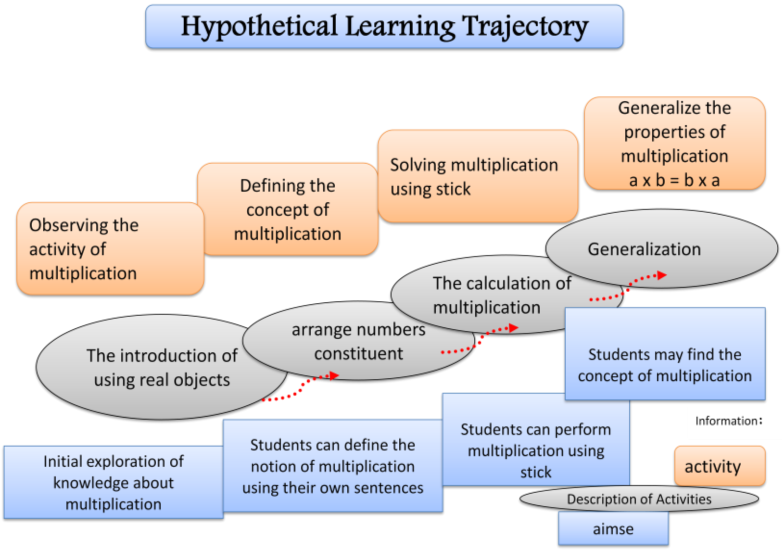
This research resulted in the trajectory of learning on learning multiplication operation by using a stick.The instructional design have been made in the study was at the preliminary design stage. The following activities conducted by researchers at the stage of preliminary design:

LITERATURE

At this stage, a literature review regarding the material multiplication, mathematical approach realistic Indonesia (PMRI), the curriculum used in schools where researchers will conduct research and researchers also held discussions with mathematics teachers regarding classroom conditions and what things are needed as long research ongoing.Based on a study conducted by researchers turns multiplication material has been known ever since they were students in the third grade elementary school and further deepened when the students were in the fifth grade elementary school.Multiplication material including material that is difficult to understand the students, this data is obtained based on the results of interviews with the subject teachers concerned. In addition, approach a realistic mathematical Indonesia (PMRI) have not been applied in SD NegeriMegang Way.

DESIGN *HYPOTENICAL LEARNING TRAJECTORY*

Hypothetical Learning Trajectory (HLT) is a hypothesis or conjecture how the thinking and understanding of students thrive in a learning activity which in this study using aapproach to realistic mathematics Indonesia (PMRI).HLT is composed of the three components ie: a. The purpose of learning mathematics for students; b. Learning activities and contexts that are used in the learning process; c. Conjecture process of learning how to identify the understanding and strategies for emerging and developing students when learning activities done in class. Here HLT developed at the stage of preliminary design:



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Development of math worksheets based on APOS model (a case study of Integral Calculus)

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Abstract

The study entitled Development of Instructional Model Calculus Based on the Theory APOS, has produced Learning Model Calculus Based on the Theory APOS (MPK-APOS), MPK-APOS provides a narrow space that extended into Development of Mathematical Model Based Theory APOS (Model APOS), A Case Study Calculus Integral. Model APOS has a syntax that consists of phases: orientation, practicum, Group Discussions, Classroom Discussions, Exercise and Evaluation, and has been declared valid, practical and effective. One of the support system of the Model APOS is APOS Model-Based Spreadsheet. Model development in other research Worksheet that follows the general model design development according to Plomp which consists of three stages or phases, namely: a preliminary study (Preliminary Research), the prototype stage (or Prototyping Development Phase), and the assessment phase (Phase Assessment). Results prototype of Worksheet berbasil APOS Model consists of: Practical Worksheet, Worksheet Manual, Diskisi Sheet Grades, Exercises Sheet. Based on the validity of the test results by 3 experts values obtained with an average of 92.06%. and included the category of very valid, test the practicalities, generating an average value 76.61% and categorized as practical, as well as the effectiveness test resulted in an average value of 80, 43% M, and in the category effectively. Worksheets can be concluded that the very valid APOS Model-based, practical, and effective. and received a positive response from students.
Keyword: APOS Model, worksheet based on APOS model, valid, practical dan efective

INTRODUCTION

Started from the problems encountered in the study of mathematics, especially calculus, as well as the importance of Calculus to assist students in developing thinking high levels, and the importance of innovation in learning Calculus, it has developed a Learning Model Calculus Based on the Theory APOS (MPK-APOS), valid , practical and effective (Hanifah, 2015). When the MPK-APOS was translated in english, the acronim was not appropiate. MPK-APOS when the syntax was implemented in other mathematical subjects, the acronim became not appropriate. It is seen that the term MPK-APOS provides a narrow space so that the titles developed into Learning Mathematical Model Based on the Theory APOS (APOS Model, A Case Study of Integral Calculus).

In general the results of the model construction Model construction use by Joyce and Weil (1992), obtained the prototype design / early draft of Mathematics Learning Model based on the theory APOS (Model APOS) as figure 1.

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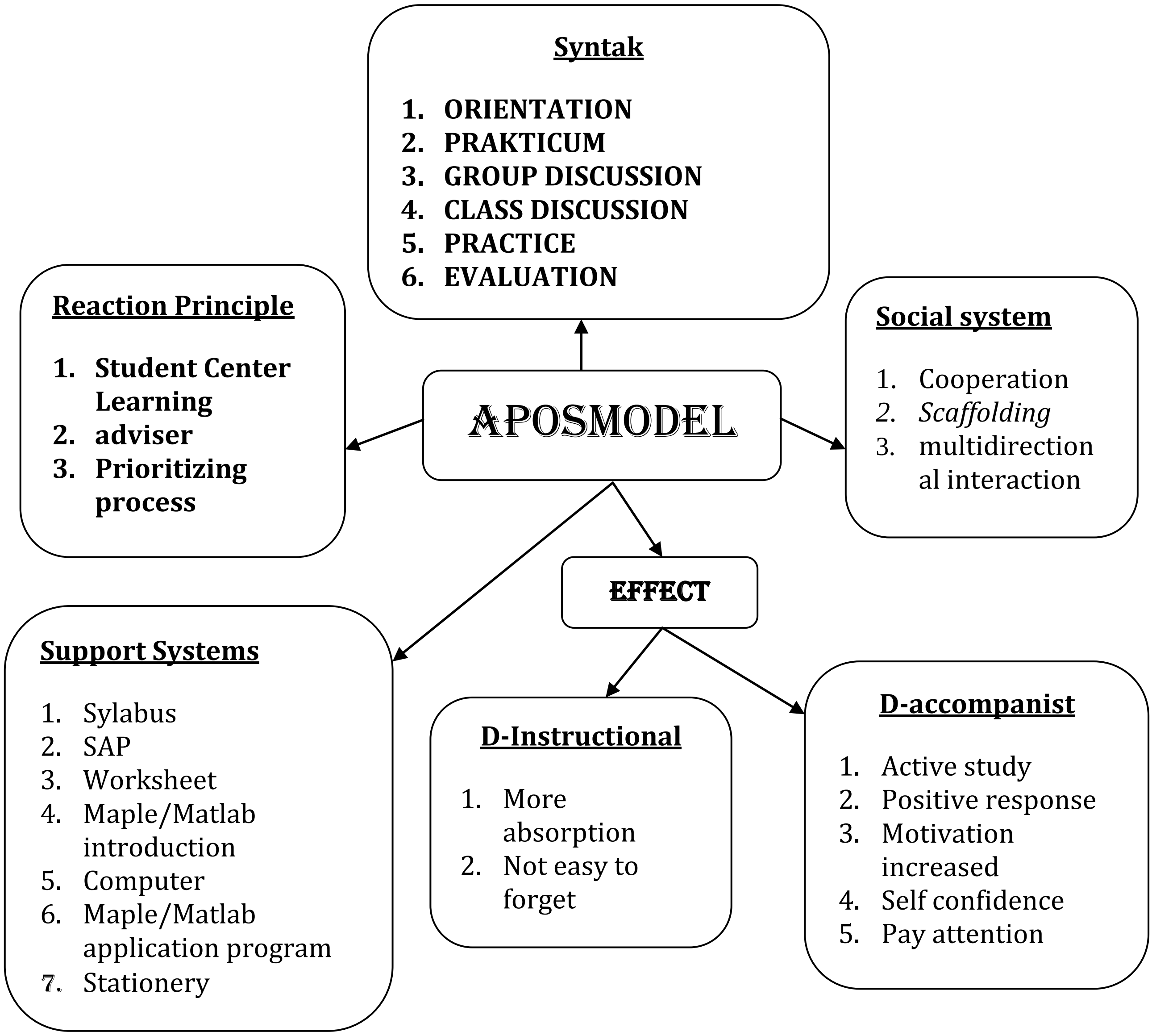


Picture 1 Learning Model
Math based on APOS theory (adopted fromHanifah, 2015)

The need for the development of Model-Based Spreadsheet APOS because they want to innovate in learning mathematics. According DitJenDikti (2012), changes in the approach of learning centered learning lecturers becomes a student centered learning paradigm change, ie a change in the way of looking at some things in the learning, they are (a) knowledge, from knowledge which is seen as something that is so staying transferred from professors to students, become knowledge is seen as a result of construction or transformed by the learner, (b) study, which received the knowledge (passive-receptive) to learn is to find and construct knowledge actively and specific; (c) learning, the faculty of imparting knowledge or teaching (lectures and courses) became a lecturer participating with students build knowledge.With the paradigm of the three principles that must exist in a student centered learning,they are: (a) view knowledge as something that is not complete yet; (b) view learning as a process to reconstruct and seek knowledge to be learned; and (c) view the learning process not as a process of teaching (teaching) which can be done in the classical style and not a process to run a standard instruction that has been designed. The learning process is a process of lecturers

provide a wide range of strategies and methods of teaching and learning approach students will understand to be able to develop the potential of students (Sailah dkk, 2012).
Development of Model-Based Spreadsheet APOS influenced by the cone theory learning experience. According to the cone theory learning experiences like the one in Figure 2, shows that if conventional teaching faculty, then that could be remembered by the students of less than 30%. Student-centered learning that anyone can remember students Greater than 50%. Activity class discussions able to make students remember more of which is 70%.

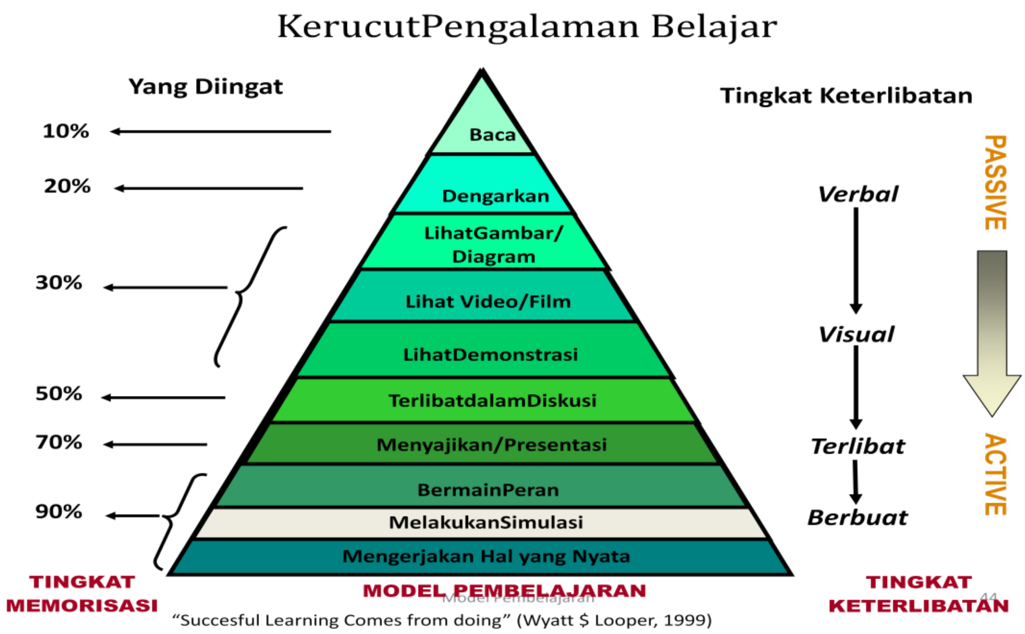


Figure2. The cones of Learning Experience (Zuriah, 2012)

PROBLEM FORMULATION

Problem Formulation of this article is:

1. How does the development of Model-Based Spreadsheet AMOS valid, practical, and effective?
2. What is the level of validity, practicality and effectiveness of APOS Model-Based Spreadsheet?

Objective

The objective of this study are:

1. How does the development of Model-Based Spreadsheet AMOS valid, practical, and effective?
2. What is the level of validity, practicality and effectiveness of APOS Model-Based Spreadsheet?

METHODOLOGY

Development Sheet Karja Based Model APOS refers to a general model of design development according to Plomp (2013: 19), which consists of three stages or phases, namely: a preliminary study (Preliminary Research), the prototype stage (Development or Prototyping Phase), and assessment phase Assessment Phase).

Based on the three-phase development procedure according to Plomp (2013), then the form of the activities undertaken in the development of Mathematics Worksheet based APOS Model consists of: preliminary research phase, the prototype stage, and the stage of assessment. The activities carried out in the preliminary study are: Initial Investigation (prelimenary investigation) about the need for the development of Model-Based Spreadsheet APOS; Analyzing the purpose and content of the courses Calculus II as the material selected for examination ;, analyze sources of learning. Activities undertaken at the prototype stage are: Model-based Design Worksheet APOS; To test the validity of the prototype; Revised the prototype based on the validity of test results; To test the practicalities of the prototype; Revised the practicalities of a prototype based on test results; Activities performed on the stage of the assessment are: To test the effectiveness of the prototype; Revised the effectiveness of the prototype based on test results.

Results Development of Model-Based Spreadsheet APOS

1. Prototype Model-Based Spreadsheet APOS

Worksheet (LK) which is designed LK which will support the implementation of APOS Model. LK-based model APOS this will not replace the role of the main sources of the book as a source of learning, but it will encourage students to read books like the main source.

LK designed guided by, syntax APOS Model, syllabus, books and SAP sources. In this phase Worksheet (LK) consists of Part I Worksheet Practicum (LKP), part II Worksheet Manual (MFI), section III Class Discussion Sheet, and section IV Exercise.

LKP contain tables that contain Maple commands about a subject, and the answers Maple. Maple commands selected are the commands that can help explain the steps to solve a problem Calculus II, not a command that directly provide answers. Under the table was reserved questions that will help students to understand the answers of Maple following Maple commands were executed. MFI contains questions or questions about the subject being completed manually. Classroom Discussions sheet contains questions or questions that will be discussed in class by a group selected. Exercise sheet contains questions that will be resolved in the classroom or at home.

The pictures below is a fragment of the contents LK-2 Area of polygon for each phase of the syntax Model APOS.

Practicum

Notes :behind # is a description and not processed Maple

- restart; with(plots):
- with(student):

Command to clear the memory; order for the graph can be painted; order for the area of the polygon can be calculated etc.

f:=x->x^2; a:=0; b:=4; n:=2;

The command to write function f(x) = x^2 ,for a=0, b =4 and a lot of partitioning n = 2

- leftbox(f(x),x=0..4,2);

#thecommand to paint the area based on the left polygon (polygon in) to a=0 dan b=4 with the number of partitions n = 2

- **Delta := (b-a)/n;**

 # command to calculate the width of the partition

- **x[k] := k*Delta;**

*# command to specify the value of the function at the point x_k */*

- **Sum(f(x[k])*Delta,k=0..(n-1)): % = simplify(value(%));**

 # command to calculate the total area of each rectangular in shape sigma emblem, and command to calculate the results for k=0 until k=(n-1)/*

- **leftsum(f(x),x = a..b,n): Luas := evalf(%,10);**

 # command to calculate luas`daerah based on an extensive number of polygons left), and a command to display the result as a decimal number.

Diskusi Kelas

Jelaskanlah dengan ringkas disertai contoh, bagaimana caranya menghitung luas daerah dengan bantuan Poligon Luar (Kanan).

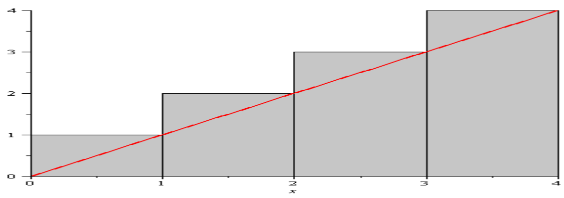
Diskusi Kelompok

Pertanyaan pada LKP

- Amatilah dan salinlah gambar hasil jawaban Maple untuk perintah nomor 1 kemudian hitunglah secara manual (tanpa bantuan komputer) berapa luas poligon-poligon yang berwarna hijau tersebut.

Soal pada LKM

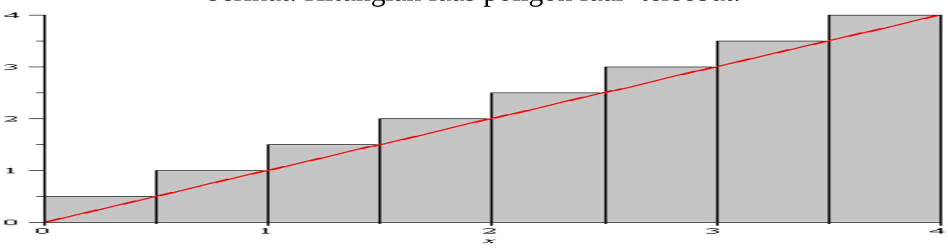
1. Diketahui f(x) = x dengan a = 0 dan b = 2 , dan n = 4 dan poligon-poligon seperti pada Gambar 2 berikut. Hitunglah luas poligon-poligon luar tersebut



Gambar 2

Latihan

1. Diketahui f(x) = x dengan a = 0, dan b = 4, n = 8, dan poligon luar seperti Gambar 2 berikut. Hitunglah luas poligon luar tersebut.



Gambar 2

Gambar 6. Soal Latihan pada Lembar Kerja

2. Uji Validitas

Tabel 1. Rekapitulasi Hasil Uji Validasi Lembar Kerja

No	Aspek Penilaian	Rerata			Rerata Akhir	Persen -tase	Kate gori
		V-1	V-2	V-3			
1	LK Praktikum	4	4.9	4.9	4.6	92	Sangat Valid
2	LK Manual	4	5	4.8	4.6	92	Sangat Valid
3	Lembar Diskusi Kelas	4	5	4.5	4.5	90	Sangat Valid
4	Lembar Latihan	4	5	4.5	4.5	90	Sangat Valid
5	Dampak LK	4.14	5.00	4.86	4.67	93.33	Sangat Valid
	Rerata Akhir	4.11	4.98	4.72	4.60	92.06	Sangat Valid

Validity test performed by 3 experts. The results are as shown in Table 1. Practical Worksheet containing Maple command and questions which will be discussed in small groups, with a very limited time provided scored 92%. MFIs that contains questions that were completed manually scored 92%. Classroom Discussions sheet can be a value of 90%, Skillsheets scored 90%, and the impact of the application of LK scored 93.33%. In general it can be concluded Worksheet Mathematical Model Based APOS designed is very valid.

3. Test of practicalities

Based on the development of procedures Worksheet APOS Model Based on the above, the practicality test APOS Model-based Worksheet included in the prototype stage. Worksheet practicality Test of-based model APOS is done individually (lecturer class A, class B lecturer), small group (assistant), and a large group (Class A and Class B).

a. Individual Test

Individual testing by faculty aims to determine whether APOS Model-based LK feasible. Selected lecturers are lecturers Calculus II which controls the application program Maple, where the command is used on the Worksheet Maple Practicum (CGC). The reason why the selected lecturers are lecturers in order to provide an assessment properly based on knowledge and experience, as well as the provision of lecturers to be a mentor on the implementation of Model-APOS trials. Weakness and incompleteness of information encountered lecturer at LK, a matter which will be given later lecturers as scaffolding in the classroom. Results of the assessment are as follows.

LKS assessment by lecturers are as shown in Table 2.

Tabel 2. Rekapitulasi Hasil Penilaian Kepraktisan LK oleh Dosen

No	Aspek Penilaian	Rerata	Persentase	Kategori
1	Lembar Kerja dan bagiannya	3.97	79.38	Praktis
2	Lembar Kerja Praktikum	3.81	76.14	Praktis
3	Lembar Kerja Manual	3.5	70	Praktis
4	Lembar Diskusi Kelas	3.875	77.5	Praktis
5	Lembar Latihan	3.72	74.38	Praktis
6	Dampak penerapan LK	4.08	81.56	Sangat Praktis
	Rata-rata Akhir	**3,83**	**76,49**	Praktis

Practicality LKS by lecturers UNIB expressed in Figure 7.

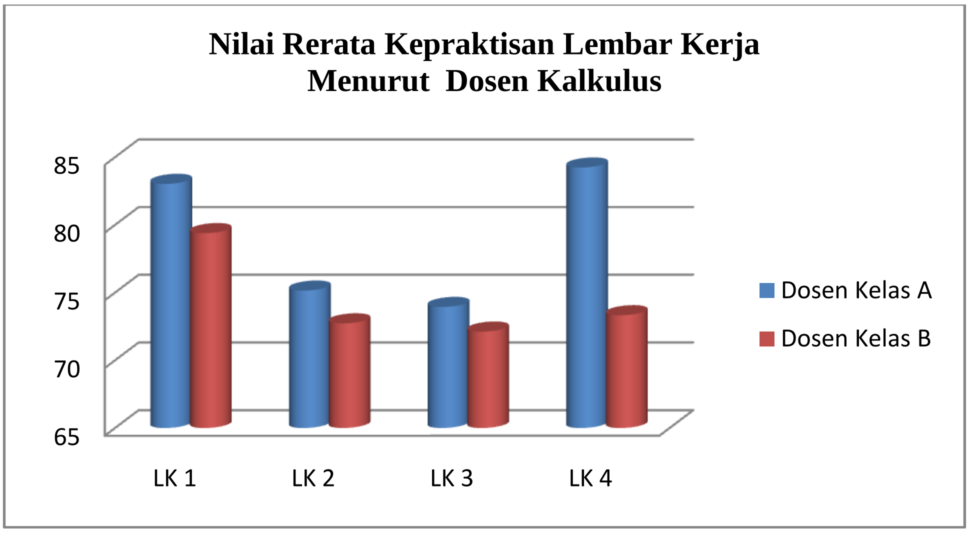


Figure 7. Grafik Rekapitulasi Nilai Kepraktisan LK oleh dosen Kalkulus

b. **Trial for Small Group by Assistant**

Small group trial conducted at three university students who became assistant courses Calculus II and Calculus II Project. The assistants have to master calculus and application program Maple. The assistants use LK in groups. Results of the assessment are as shown in Table 3 assistants.

Tabel 3. Rekapitulasi Hasil Kepraktisan LK oleh Asisten

No	Aspek Penilaian	Rerata					Persen -tase	Kate -gori
		LK-1	LK-2	LK-3	LK-4	Rerata		
1	Lembar Kerja (LK) dan bagiannya	4.75	4.5	4.75	4.75	4.69	93.75	SP
2	LK Praktikum	4.45	4.18	4.45	4.82	4.48	89.55	SP
3	LK Manual	4.2	4	4.6	4.6	4.35	87	SP
4	L Diskusi Kelas	4	5	5	5	4.75	95	SP
5	L Latihan	4.5	4.5	4.5	4.5	4.5	90	SP
6	Dampak LK	4.5	4.5	4.5	4.5	4.5	90	SP
	Rerata Akhir	4.4	4.45	4.63	4.70	4.54	90.88	SP

Catatan : SP = Sangat Praktis

c. Uji Kelompok Besar/Kelas oleh Mahasiswa

Uji kepraktisan Lembar Kerja oleh mahasiswa dilakukan pada kelas A dan kelas B.

Tabel 4Rekapitulasi NilaiKepraktisan LK olehMahasiswa Kelas A

No	Aspek Penilaian	Rata-Rata Kepraktisan LK (%)				Kategori
		LK 2	LK 3	LK 4	Rerata	
1	Lembar Kerja dan Bagiannya	72.05	74.13	73	73.06	Praktis
2	Lembar Kerja Praktikum	77.77	78.74	73.18	76.56	Praktis
3	Lembar Kerja Manual	72.18	75.13	72.6	73.30	Praktis
4	Lembar Diskusi Kelas	75.45	76.52	77	76.32	Praktis
5	Lembar Latihan	77.95	80.43	77.25	78.54	Praktis
6	Dampak Penerapan LK	78.98	83.80	80.25	81.01	Sangat Praktis
	Rata-Rata Akhir	**75.73**	**78.13**	**75.55**	**76.47**	**Praktis**

Tabel 5 adalah penilaian kepraktisan LK oleh mahasiswa kelas B

Tabel 5Rekapitulasi NilaiKepraktisan LK oleh Mahasiswa Kelas B

No	**Aspek Penilaian**	**Rata-Rata Kepraktisan LK (%)**				**Kategori**
		LK 2	**LK 3**	**LK 4**	**Rerata**	
1	Lembar Kerja dan Bagiannya	83.82	74.14	80.36	79.44	Praktis
2	Lembar Kerja Praktikum	80.59	77.62	77.01	78.41	Praktis
3	Lembar Kerja Manual	76.94	74.90	76.43	76.09	Praktis
4	Lembar Diskusi Kelas	80	77.24	80	79.08	Praktis
5	Lembar Latihan	81.03	78.79	75	78.27	Praktis
6	Dampak Penerapan LK	82.72	80.43	77.679	80.28	Praktis
	Retata Akhir	**80.85**	**77.19**	**77.7**	**78.59**	**Praktis**

In general practicality LKS by students for LK 2, LK 3, LK 4 is like Figure 8.

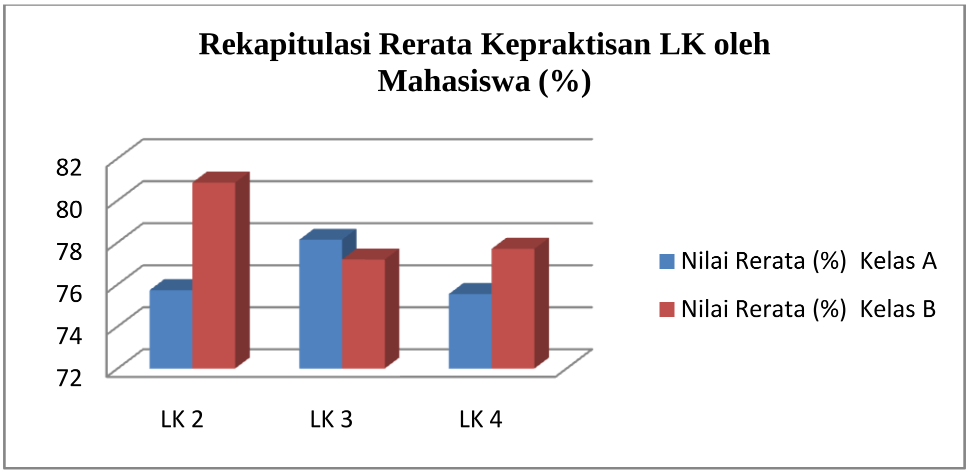


Figure 8. Graph Summary of Practicality LKS by Students

On the graph shows that the value of practicality for each LK namely: LK-2, LK-3, and LK-4, by students of Class A and Class B students value> 70%, and included a practical category. At the LK-2 student class B gives a very high score far exceeds class A. At the next meeting to do the turn of some functionality in the 3-LK and LK-4 so that the functions contained in the LK-LK 3 and 4 are already in ujicobakan by the assistant is not the same as the LK-3 and LK-4 good for class A and class B. There was a decrease to an average value of each class, but still includes practical category.

4. **Test of Effectiveness**

Test Worksheet line with APOS Model test. The instrument used to test the model APOS well as a test of the effectiveness of APOS Model-based Worksheet. So the effectiveness of the test results to be APOS Model effectiveness test results of the Worksheet. In general the effectiveness of the test results and the APOS Model Worksheet as his main supporters are as follows.

Tabel 6. Rekapitulasi Hasil Uji Efektifitas MPK-APOS

No	Instrumen	Presentase	Kategori
1	Kemampuandosen mengelola Model APOS (Mengelola Lembar Kerja)	78.70 %	Efektif
2	Aktivitas Mahasiswa	96.765 %	Sangat Efektif
3	Respon Mahasiswa	79.17 %	Efektif
4	Motivasi Awal Mahasiswa	79.13 %	Efektif
5	Motivasi Akhir Mahasiswa	81.08 %	Sangat Efektif
6	Nilai Postes	67.75	Efektif
	Rerata Akhir	**80.4325**	**Efektif**

From Table 6 shows that the average final effectiveness test is 80.6325% effective and inclusive category. The highest value obtained for the student activity with a mean value = 96.765%. This means that MPK-APOS supported by Worksheet based MPK-APOS consisting of Worksheet Practicum (LKP), Worksheet Manual (MFI), Sheet Discussion Class, and Skillsheets, with the availability of very limited time for each of them, it turns out can increase the activity of students. It is of course inseparable from the role of professors as mentors. The presence of observers influence keaktivan students.

The smallest value obtained for postes in which a mean value = 67.75. This shows that's not easy to improve student results. Many of the factors that influence it. Tested material that is difficult about using integral to calculate the area of flat fields, and to calculate the volume of rotating object. These issues require students to be able to paint charts. From the preliminary study has been explained that the students generally difficult to paint charts. But the average value of the intervals used UBH assessment includes both the effective category.

DISCUSSION

Test Worksheet on practicality there are some revisions. Revisions were made because there was a mistake in typing the contents of the Worksheet. Revisions should be done on lab sheets to avoid cheating students practical answers.

Worksheet (LK) Model-based support system APOS is the most influential on the application of APOS Model. Not easy to prepare LK good and right on target. Sometimes Maple appropriate command has not been found to explain a concept. To overcome these weaknesses LK, it takes the expertise of lecturers provide rock that is when the help is given and what assistance could be provided so that students can find the conclusions of aid lecturers.

Learning from experience to test applying Model-Based Spreadsheet APOS, many factors influence that APOS Model can be valid, practical and effective. The completeness of material preconditions, faculty expertise to provide assistance, the activity of students during the learning takes place is the motivating factor the successful mastery of Calculus II (Integral).

From a series of trials that have been conducted since 2013 to 2014, the lessons learned are:

a) The ideal conditions that Model-Based Math Worksheet APOS run optimally when a student is in the classroom can be formed into a heterogeneous group. Lecturer easily provide relief. Students are able to master the material well, it looks at the implementation of the class discussions, many questions could be discussed in front of the class. Quiz conducted a successful run. So it can be concluded that the application of model-based LK APOS will be successful if the material is easy to understand the students, a heterogeneous group, and professors are able to provide good guidance.

b) Although the group has been heterogeneous, but the material is difficult to understand, then the LK-Based Model APOS can be done well if the supervisor is able to provide guidance well.

c) Although not a heterogeneous group, and the material is difficult to understand, but because the lecturers are able to provide better guidance to the implementation of Model-based LK APOS can be done well.

d) The conditions were not ideal occur if the material is too hard to digest, solid contents and takes a long time to understand it. Required additional time and expertise of lecturers provide assistance.

e) The conditions were not ideal occurs when a class can not be formed heterogeneous and lecturers are not able to provide guidance well.

f) If Sheets Practical can not be done, then teachers should be ready to provide assistance in the conventional.

g) Learning to use model-based LK APOS very powerful tool to improve learning outcomes, activities, motivation, and student response, when a group of students is heterogeneous, with a small number of students and faculty expert assistance.

h) Model-based Worksheet APOS is very powerful when applied to classes where the number of students who are more clever than the weak students

i) Need guidance and attention lecturer on vulnerable groups when applying LK APOS Model based on the class that can not be divided into heterogeneous groups.
j) If the class with a large number of students making it impossible for lecturers to come to each group to provide assistance, it is necessary to provide assistance kepiawauan lecturer in classical.
k) Worksheet based APOS Model can be used without having to be in the computer lab. In this case Each group must have a laptop so that Maple can be run as an application program, so that the practical phase can be implemented.
l) If the practicum phase is difficult to implement, the lecturers should be able to replace them with a way to provide assistance by directing students in a way that students can master the material. In this case the method of question and answer with the model of guided discovery is more appropriately used.
m) To parallel classes, then the problems that exist on the Worksheet may not be the same between one class to another class, so that students are not cheating by copying answers LK already done by the previous class students. Therefore lecturers using LK must be willing to change the functions or numbers on the LK so the answer is no longer the same.

For your consideration if you want to apply Model-based Worksheet APOS, according Harsono (2005), the advantages of student centered learning are: (1) to include students in the learning process; (2) encourage the students to have more knowledge / wide / deep; (3) Establish the students with real life; (4) promote active learning; (5) encourage critical thinking; (6) directs students to recognize and use a variety of learning styles; (7) the needs and backgrounds of students; (8) provide an opportunity for the development of a variety of assessment strategies.

CONCLUSION

Development of Model-Based Math Worksheet APOS, has produced a valid Worksheet, practical, and effective. Spreadsheet-based model APOS support

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IMPROVEMENT MATHEMATICS LEARNING BY USING REALISTICS MATHEMATICS EDUCATION (RME) IN THE FIFTH CLASS AT ELEMENTARY SCHOOL NO. 001/XI SUNGAI PENUH

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Abstract

Elementary School (SD) is the stage when the teacher laid the foundation of a variety of building science, including mathematics. If since elementary school student has embedded the concept of the right, at the next level they are not too difficult, as the general impression has been formed. Learning Realistic Mathematics Education (RME) combines mathematical insights into what it is, how students learn mathematics and how mathematics should be taught. Students should not be seen as an object of study, but as a subject of study. Realistic Mathematics Education (RME) using a real phenomenon and applications of the students in the learning begin. The purpose of this study was to analyze the mathematical ability of students on the material arithmetic operations on fractions using the approach of Realistic Mathematics Education (RME) in class V Elementary School (SDN) 01 / XI Sungai Penuh. This study is a research design (Design Research) using Hypothetical Learning Trajectory (HLT) as a research instrument which will be revised every meeting. Based on the research data it can be concluded that the RME learning approach can improve the activity and understanding the concept of arithmetic operations on fractions math class V students SD No. 001 / XI Sungai Penuh of the academic year 2014/2015. Students' learning activeness increased after learning approach implemented Realistic Mathematics Education (RME) when researches share paper colors and ask them to divide the paper into several pieces. After they cut the paper, they put it in accordance with pieces of paper of equal size.

Keyword : Realistic Mathematics Education (RME), Design Research, HLT, Elementary School

INTRODUCTION

The era of globalization accompanied by rapid development of science and technology, then one is required to be able to utilize the information properly and quickly. For that, it takes a Human Resources (HR) quality and high reasoning and the ability to develop science and technology. UNESCO-APNIEVE SOURCE BOOK set four main pillars of education in facing up to the 21st century, namely: (1) learning to know, (2) learning to do, (3) learning to be, and (4) learning to learn, which is then fitted be learning to live together in peace and harmony. Taking into account the educational goals, the math should be able to be one of the means to increase the power of reason and the students can improve their ability to apply mathematics to face the challenges of life in solving problems. [1]

To improve the quality of mathematics teaching in the classroom, it would require the development of quality learning materials. If observed in mathematics textbooks students some of the material presented in the textbook of mathematics in class 5th many use deductive reasoning, so no complaints of the students in learning the material from textbooks that is hard to understand mathematical concepts. In addition, the material presented lack of linkages between mathematics learning in school to the real world (real) and the daily life of students that mathematics courses include subjects that are difficult and dreaded students. One of the characteristics of mathematics is to have an object that is abstract. The abstract nature causes many students have difficulties in mathematics. In line with technological developments, in the field of education is also a lot of developing various approaches and teaching methods. One is learning to use the approach of Realistic Mathematics Education (RME). First developed in the Netherlands by Hans Freudenthal. Realistic Mathematics Education (RME) combines mathematical insights into what it is, how students learn mathematics and how mathematics should be taught. Students should not be seen as an object of study, but as a subject of study. [2]

Realistic Mathematics Education (RME) using a real phenomenon and applications of the students in the learning begin. With a set of contextual questions, students are guided by teachers constructively until they understand math concepts learned. So from mastering this concept, students are expected to acquire good learning performance anyway.

FORMULATION OF THE PROBLEM

Based on the background of the problem, the research problems can be formulated in the form of the following questions: How does the development of activities and understanding the concept of student learning material of mathematics at the material arithmetic operations on fractions using the approach of Realistic Mathematics Education (RME) in class V Elementary School (SDN) 01 / XI Sungai Penuh?

THEORITICAL REVIEW

1. Learning Math

Learning mathematics at school demanding the teacher's role in managing the learning environment as possible so the students through the process of learning mathematics well. The math teacher will be able to teach mathematics to students in accordance with the purpose of learning if he understands the nature of mathematics and taught in accordance with the methods and learning strategies appropriate and relevant. Not only the depth of the concept given to the students who should be adjusted to the level of ability, the way the material was similarly. [3]

Teachers need to know the level of mental development of children and how teaching should be done in accordance with the stages of development. Learning which does not consider the stage of mental development of the students most likely to result in the student having difficulty, because what is presented on a student does not comply with its ability to absorb the material provided.

The first general purpose learning of mathematics in primary and secondary education is the emphasis on reasoning structuring and formation of students' attitudes. The second general objective is to give emphasis on skills in the application of mathematics, both in everyday life and in helping others learn about science. [3] In horizontal mathematization students with their knowledge can organize and solve real problems in everyday life, in other words mathematical horizontal moves from the real world to the world of symbols. While vertical mathematization is the process of reorganization by using mathematics itself, so mathematical symbols vertical moves of the world. [2]

2. Realistic Mathematics Education (Realistic Mathematics Education)

Realistic Mathematics Education (RME) is a theory of teaching and learning in mathematics education. The theory of Realistic Mathematics Education (RME) was first introduced and developed in the Netherlands in 1970 by the Freudenthal Institute. [2] This theory refers to the opinion of Freudenthal who said that mathematics should be associated with reality and mathematics is a human activity. This means that mathematics should be close to the child and relevant to real life everyday. Mathematics as a human activity means that humans should be given the opportunity to rediscover the ideas and concepts of mathematics with the help of an adult.

Realistic Mathematic Education (RME) guide students to "reinvent" mathematical concepts ever discovered by mathematicians or when allowing students to find things that have not been found. [3] According to Zukardi in Sipardi Realistic Mathematic Education (RME) is a teaching approach that starts from things that are real for the students, emphasizing the skills proces of doing mathematic, discuss and collaborate, argue with classmates so they can find themselves and ultimately use mathematics to solve problems, both individually or groups.

Realistic mathematics learning process using the contextual problems as a starting point in learning mathematics. Contextual issues in question are real issues and concrete close to the environment students and can be observed or understood by the students to imagine. In this case the student do the math horizontal, ie students organize the problem and trying to identify the aspects of mathematics that exist on the matter. Students are free to describe, interpret and resolve the contextual problems in its own way with the knowledge of the ones, then with or without the help of a teacher using mathematics vertically (through abstraction and formulations), so as to arrive at the stage of concept formation. Having achieved the establishment of the concept, students apply these concepts back on contextual issues, so as to understand the concept.

RESEARCH METHODS

The research method used in this study is a research method Design Research and the type of research is qualitative. There are three phases in the design research of mutual good form cyclic processes in each phase as well as in the whole process of design research, the first phase of the thought experiment (preparation and design), the second phase instruction experiment (experiment teaching). After the teaching experiment results will be seen in the third phase for improvement theory (theory improvement). [3]

In this study, researchers will analyze the students' mathematical development by the material arithmetic operations on fractions. The study design that researchers use is to use Hypothetical Learning Trajectory (HLT) which will be revised at each meeting. HLT is used as part of what is called the cycle of teaching mathematics (Mathematical Learning Cycle) for one or two of learning, or even for more than two-learning. HLT can connect between theoretical learning (instructional theory) and learning experiment in concrete. HLT is used to guide the process of learning to the trial in accordance with the specifications of the material and learning hypotheses that have been determined in the form of HLT. [4]

To revise the instructional design phase is expected to minimize the weaknesses found in every meeting and learning can improve design productivity in mathematics at the material arithmetic operations on fractions.

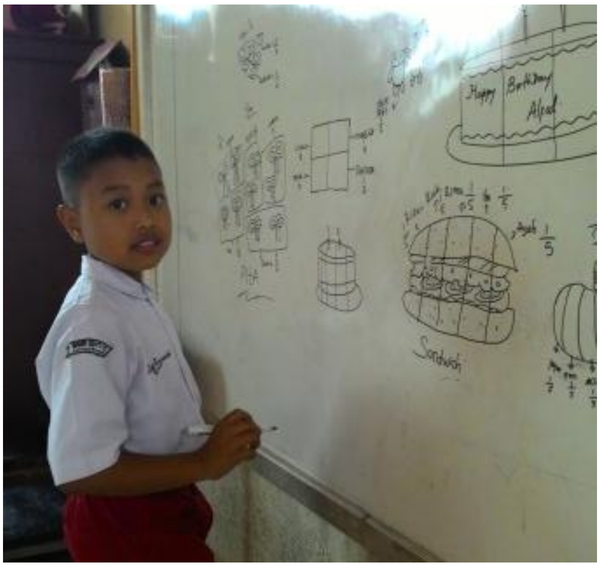
DISCUSSION

Learning mathematics by using an approach Realistic Mathematics Educations (RME) in class V SD No. 001 / XI Sungai Penuh runs well and smoothly. Instructional design that has been designed is able to increase the activity, interest, and motivation of students in learning. Learning math oriented everyday experience and apply back to the real life makes the pupils to develop mathematical ability.

Denomination is one of the core study materials students are learning math in elementary school (SD). The discussion focused on construction material (operation) is the basic arithmetic addition, subtraction, multiplication, and division. Indicate weaknesses among other covering material addition and subtraction of fractions of different denominators, and multiplication and division of fractions.

Realistic Mathematic Education (RME) guide students to "reinvent" mathematical concepts ever discovered by mathematicians or when allowing students to find things that have not been found. The theory is the main focus in the core stage of learning that students find their own knowledge of the subject of the learning arithmetic operations on fractions This raises the characteristics of RME. Their production and construction by students, who stood out during the students are working on worksheets.

Arithmetic operation was first introduced to students in the fourth grade, but the learning is then followed in class V. While in the fourth grade has embedded the concept of arithmetic operations on fractions, but in the fifth grade learning is repeated. Teaching materials developed have considered the order of reduction of material fractions. But there are things that need to be improved with regard to the process of modeling done by the students in solving arithmetic on fractions. Students are learning arithmetic operations on fractions have been able to develop and construct a mathematical model of its own to the problem given in LKS.



students construct their own mathematical models

Because of the ability of the student's basic arithmetic operations on fractions have been formed, researchers do not require a long time to discuss and explain this matter. However, planting the correct concept and its application in the real world is a major task in this study.

At the first meeting, researchers explain the basic concepts of fractions by introducing fractions by using real objects, for example: apples, sapodilla, chocolate, cookies, and others. Learning mathematics at the first meeting held by the HLT that has been designed. The design is based on the approach realistics HLT Mathematics Education (RME) which will be developed in the class.

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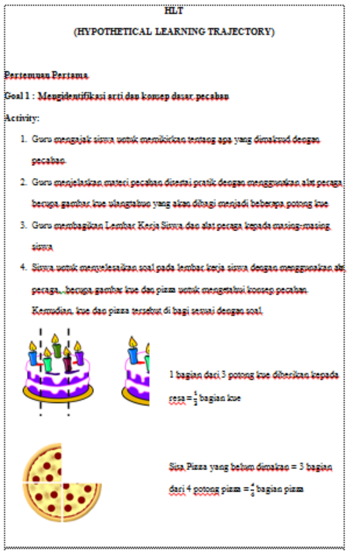
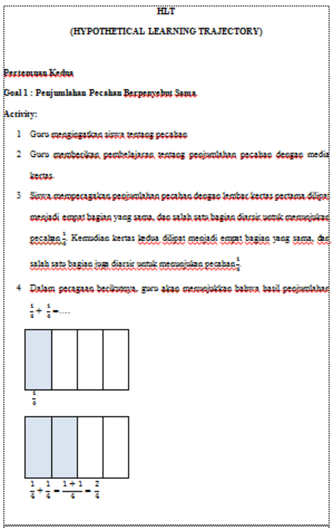


Picture. HLT First Meeting

In the above explanation can be concluded that the condition class and makes learning fun and active is an important aspect of the learning process. Learning fun and more emphasis on the real world to make students more motivated and not too late to learn mathematics is abstract. However, if the atmosphere is stiff and awkward learning makes learning not optimal and less effective. [2]

At the time of the second meeting begins learning researchers began to condition students to sit in their group. Based on the observations of researchers, then for a second meeting will be made HLT repaired by flaws in the HLT at the previous meeting.



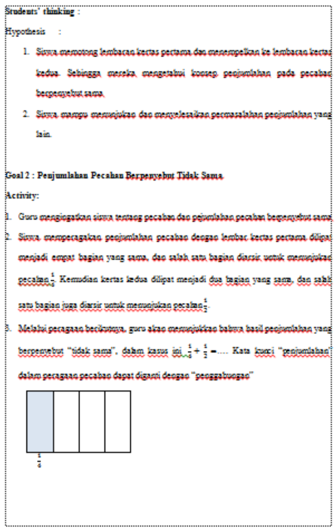


Figure HLT after revised

They were in each group to share research paper colors and ask them to divide the paper into several pieces. After they cut the paper, they put it in accordance with pieces of paper of equal size.

Images of colorful paper that has been cut up and prepared

Students discover the concept of equivalent fractions, they complete worksheets that have been shared and describe how to complete the addition operation in accordance with the concept that they find. Based on the analysis of students' answers, the researchers hypothesis is substantiated. Students are now better understand the concept of multiplication of fractions and is able to solve the problems approaching the problems in context. They were active interaction between students and researchers. Material division is a material that is difficult to explain in the real world. Therefore, researchers experimented with colored water and some plastic cups. When students make the process of colored water poured into plastic cups then indirectly the students perform repetitive reduction surgery.

Pictures of students perform a division operation

In the end, it reinforces the students' understanding that the fractional division operation is repeated subtraction, as multiplication is repeated addition operation. Many students can perform arithmetic operations on fractions, but they do not understand the meaning of such operations.

Understanding of the students in finding the concept of division of fractions needs to be developed, making it easier for them to remember and apply these concepts in everyday life. Experiments in design researchers are able to create a classroom atmosphere to be enjoyable so that students are enthusiastic in participating in learning. The activities the students was expressed very well with the percentage reached 96.25%.

The steps taken to rectify deficiencies at each meeting is to design a learning plan that approaches Realistic Mathematics Education (RME) can be applied more effectively by way of involving students more actively in the learning process. Teachers try to create a pleasant atmosphere by designing experiments relating to fractions and to obtain real problem. So that students truly understand material in the can so that the learning process more meaningful, giving guidance to the students to not be embarrassed to ask if having difficulty, at every meeting there was the turn of students who correctly answered questions. Mathematical development of students in this study experienced improvement in every meeting. It can be seen from the differentiating student understanding before the study and after the study. The percentage of students also increased activity, increased activity of students can be seen from the increasing number of students who are active in interacting with each other or with investigators. In the learning process, students are also active in asking and responding explanations and statements given by the researchers. Based on the above, it can be concluded that the mathematical abilities and activities of fifth grade students of SD No. 001 / XI Sungai Penuh using approaches Realistic Mathematics Education (RME) has developed very well and optimally. This shows the design used by the researchers is good and gives a good benefit for students.

COVER

Based on the research data it can be concluded that the approach to learning Realistic Mathematics Education (RME) can increase the activity and understanding the concept of arithmetic operations on fractions math class V students SD No. 001 / XI Village River Market Full of the academic year 2014/2015. Students' learning activeness increased after learning approach implemented Realistic Mathematics Education (RME) when researches share paper colors and ask them to divide the paper into several pieces. After they cut the paper, they put it in accordance with pieces of paper of equal size. Students discover the concept of equivalent fractions, they complete worksheets that have been shared and describe how to complete the addition operation in accordance with the concept that they find. Based on the analysis of students' answers, the researchers hypothesis is substantiated. Students are now better understand the concept of multiplication of fractions and is able to solve the problems approaching the problems in context

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Teacher Ability in Teaching of Finding π Value at Primary School

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Abstract

Teachers' ability in helping students to achieve the learning objectivesis an important aspect. Lack of teacher knowledge of the value of π and its concepts and procedures prerequisites lead teachers teach students the value of π as a constant that has a statute without understanding the basic invention. This situation is common in introducing the value of π at Indonesian primary schhol. The research center of Pendidikan Matematika Realistik Indonesia (P4MRI) ofUnsyiahhave created the instructional videos to help teachers to introduce value of π meaningfully. Teachersuse videosas a reference in implementing the learning that explores the students' understanding regarding the value of π. This article discusses some of the development process of teaching the value of π by team of P4MRI Unsyiah, namely stage measure of practicality. At this stage, there are three teachers who refer to the learning process in those videos to introduce the value of π. However, this paper only focus on one teacher. Data collected through observation, either directly or through video recordings. Data isanalyzed descriptively. The results showed teacherenthusiastic to implement teaching the value of π as video. However, in the specific learning teacher got some difficulties to assist her students in finding the value of π. This is due to mathematical concepts such as decimalnumber, place value, the value of π, and the division procedure are not controlled properly by the teacher.

Key words: teacher ability, instructional video, the velue of π, realistic mathematics approach

INTRODUCTION

Students of primary school are still at the stage of concrete operations so have not been able to think deductively. At this stage, students can understand the logical operations with the help of concrete objects (Piaget, 1985). This is in contrast to the mathematics which is a deductive thinking, formal, hierarchical and using symbolic language. Differences stage thinking students with mathematical characteristics lead to difficult math understood by students. Therefore, teachers need to have the ability to connect the world of children who have indeductive reasoning in order to understand mathematics. Teachers need to design 'the bridge'so that the abstract mathematics that looks concrete by students. Teachers need to consider to their students' need and they did not implement the same way when they were in learning process few years ago (Ambrose, 2004; NCTM, 2000).

Langer's (1989) andLee &Zeppelin (2014) revealed that the ability of teachers to give lesson needs to be improved. The capability especially with respect to the ability to create a new methods, a willingness to accept new information, the capacity to serve more than one perspective, the power to manage the context , and the desire to put the process as an important before the results. According to the NCTM (2000), an ability that is needed now is the ability of teachers to implement effective mathematics learning to understand the situation of students in order to motivate students to learn mathematics.

Effective mathematics learning requires to buildthe basis of students' knowledge. This can be achieved if teachers have the knowledge related to the good in content and pedagogical as well (Shulman, 1987). According to James and Dahl (1973) teacher mastery of the material affects the quality of learning they have implemented. Teacher mastery of the material can be seen when teachers teach because teaching is an intentional activity that is intentional and normative(Beyer, 2000; Smith, 2000).

Romberg & Carpenter (Senger, 1999)put the responsibility for the success of reform in mathematics education on the shoulders of teachers. The reformation are concerned with the approach or model of tecahing that is used in teaching mathematics. Due to the characteristics of mathematics is abstract object and deductive axiomatic, is certainly not an easy for a teacher to teach mathematics. Realistic Mathematics Educations (RME) is one approach that is expected to help teachers implement mathematics learning meaningful for students.

RME is an approach to use reality as a starting point in the process of teaching and learning mathematics which aims to help students build and reinvent mathematics through solving contextual problems in an interactive way (Gravemeijer, 2010). RME very concerned aspects of informal mathematics (horizontal mathematization) as a bridge to deliver on the students' understanding of formal mathematics (vertical mathematization).

The characteristics of RME are using context, using the model in solving mathematical problems, using the student contribution, interactivity, and intertwine. Context or problems realistically be used as the starting point of learning mathematics. Context does not have to be a real-world problem, but can be in the form of games, the use of manipulative, or other situations as long as it is meaningful and can be imagined in the minds of students. Through the use of context, students are actively involved to conduct exploration activities issues. Another benefit of using the context in the beginning of lesson is to increase student motivation and interest in learning mathematics(De Lange, 1996; Treffers, 1991; Gravemeijer, 1994).

The importance of improving teachers' ability to carry out meaningful learning for students requiring concrete action. Efforts have been done that is through teacher training. But until now it was felt that the results of the training that has been done has not been maximized. Therefore, the strategy of training needs to be chenge into mentoring teachers to improve their ability(Kemendikbud , 2014).

Mentoring teachers to improve the competency of teachers was conducted by the Center for Research and Development of Indonesian Realistic Mathematics Education (P4MRI) UniversitasSyiah Kuala (Unsyiah) since 2006. To get the best effect, mentoring was done by utilizing instructional video. This article aims to explain about the ability of teachers in implementing the learning value of π refer to instructional video.

METHODS

Development of mentoring teachers who implemented P4MRI Unsyiahfollow the stages of development research by Plomp (1997). There are five stages, namely (i) the initial assessment, (ii) design, (iii) the realization/construction, (iv) test, evaluation and revision, and (v) implementation. Development of teacher mentoring at the stage of testing, evaluation and revision expected to be obtained mentoring activities are valid and practical. Testof practicality of the mentoring has been developed involving three teachers of PMRI partners school in Banda Aceh. This paper describes the process of learning the value of π conducted by a teacher and focus on one of three lessons.

Mentoring activity of P4MRI Unsyiah

Mentoring begins with giving workshops to teachers. Through workshops, teachers' understanding of the principles PMRI are reviewed. Teachers sharetheir experiences how to introduce the value of π to students through discussion. Teachers are encouraged to assess their own way to introduce the value of π has been done from the aspect of meaningfulness in student understanding. It aims to provide an opportunity for teachers to reflect on their own teaching as a way to change their beliefs and determine best practices for their students(Cooney, 1999; Schön, 1983; Simon, 1995). These activities hope helping teacher to think about the effective teaching.

The workshop also explored teachers' understanding of the meaning and value of π appropriate strategies introduced to the students . This activity is done to help teachers understand the true content of mathematics is taught. Researchers realized that the teachers 'understanding of the mathematics content directly affect the students' understanding(Hill, Rowan & Ball, 2005).

The next activity was teacher watch instructional video, guided by a facilitator to find important events in video. It aims to help teachers understand the learning path and the importance of students' understanding. Teacher's knowledge of how the student's thinking is the main component ofpedagogical content knowledge in tecahing mathematics (Shulman, 1987; An, Kulm& Wu, 2004).

Teachers are given sufficient time to really understand the steps of teaching through instructional video. After the workshops, mentoring activities continued with the observation and recording of the teachers implementing the learning in each class. Teachers are given freedom in implementing the learning process. This can be done because it has facilitated learning about the advantages and disadvantages of the video. In addition, teachers are also given the freedom to innovate with regard to the idea of teaching and learning resources. Recording is done for the purpose of reflection on next workshop.

Data collected through students' written works, field notes, audio, and video of the learning process. Data analyzed descriptively to show the critical moment of teaching mathematics process.

RESULTS

At the beginning of her lesson, teacher inform the radius and diamtere of circle on the white board. Then, she demonstrated how to find the center point of circle (see Figure 1).

Figure1.Teacher demonstrated how to find the center point of circle

The next step, teacher delivered the problem related to the length of ribbon needed to sew the cover of the fan. Teachers and students measure the circumference of the fan to resolve such issues as shown in Figure 2.

Figure2.Teacher and her student measure the circumference of fan

Teachers also demonstrate how to measure the circumference and diameter of the other circle objects, it is a top of topless. She found the circumference is 100 centimeters and a diameter is 30 centimeters. Then, teacher wrote on the board. She wrote the symbol L to declare circumference (Figure 3), instead of K as circumference of any shape.

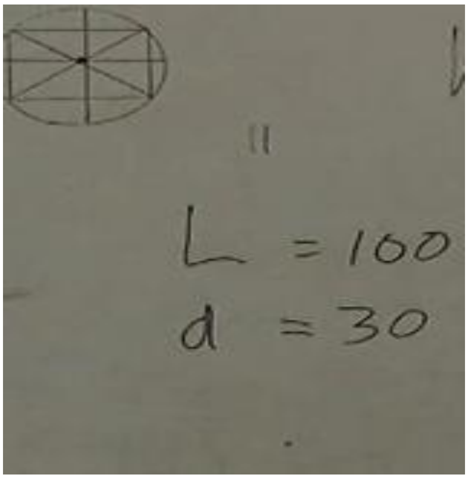

Figure 3.Teacher mistakenly use the symbol L to declare the circumference of circle

Teacher continue her lesson that determine the relationship circumference with a diameter of a circle. Teachers demonstrate division involving the measurement of circumference and diameter of a circle. However, teachers have trouble doing the division procedure (Figure 4).

Consequently, she stoped her lesson. She did not extend to introduce the value of π as the ratio of the circumference and diameter of circle, which is 3.14.

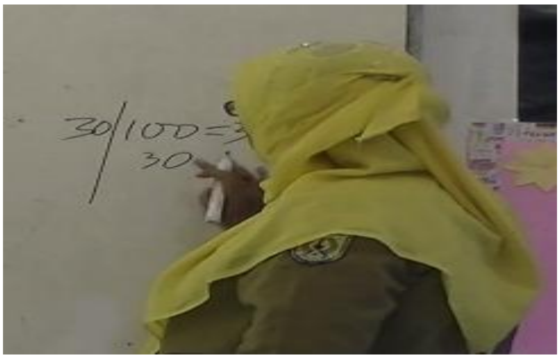

Figure 4. Teacher was not correct to use division procedure

DISCUSSION

During the learning process, teacher did not engage her students in finding the concepts. She transfered her knowledge to her students. This situation may lead teachers do not get information about students' understanding or misunderstanding of the concepts taught.

Teachersshould have knowledge about her students' understanding. This is an important aspect to achieve the learning objectives (Marks, 1990). This knowledge enables teachers to measure how well students understand the concepts being taught, suffered misunderstandings and develop a strategy that is understood to correct an error (An & Wu, 2004). Shulman (1986), Park, & Oliver (2007) put the teacher's knowledge of pedagogy students as a knowledge center, and is regarded as one of the key components. Zuya (2014) asserts that mathematics teachers are expected to know what to make students and what is already understood.

In the specific learning process, teacher got some difficulties in introducing value of π . This situation is caused concepts and mathematical symbols that decimal place value, the value of π , and the division procedure is not controlled properly by the teacher. The lack of teacher's content knowledge were effect to learning stops and learning objectives were not achieved. This fact is in line with the opinion of Shulman (1986) that the teacher's knowledge relating to the training content is indispensable in implementing effective learning .

In term of the teachers' understanding of the content taught, Moyer and Milewicz (2002) adds that teachers who do not have a sufficient understanding of the material being taught will not be able to reveal student misconceptions. The fact that teachers, especially in the teaching of mathematics does not have a complete knowledge and inadequate with regard to the content, are very common(Carpenter, Fennema, Peterson & Carey, 1988; Chick &Chik, 2005; Zuya, 2014).

CONCLUSION

The ability of teachers in implementing the learning of introducing the value of π by learning video is still not optimal. This is due to the lack of a good understanding of mathematical concepts and material prerequisites that required.

SUGGESTION

The results show it is necessary to held mentoring activities in accordance with the state teachers. This paper reveals only a limited number of teacher's condition that requires attention. There is a possibility, there are many phenomena of ability of the teachers that also require attention. This information should be motivation to related parts in making decisions.

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The Development of Biology Learning Module Nuance Emotional Spiritual Quotient (ESQ) Integrated on Cell Topicfor Senior High School Students.

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Abstract

The aims of this research are to result valid and practice module of Emotional Spiritual Quotient (ESQ) integrated on Cell topic for Senior High School. This research used 3 step of 4-D Models: define, design, and develop. The subject research are 2 lectures, 2 teachers and 20 students from Senior High School 1 Kubung. Data is primary data collected directly from validation and practicality questionnaires. Data analyze descriptively statistic. The result shows that module of Emotional Spiritual Quotient integrated on Cell topic have 86,27%, in validity and 82,92% in practicality by teachers and 85,68% in practicality by students. It can conclude that module of ESQ on Cell topic have valid and practice to use in learning.

Key Words — Development learning material, ESQ on Cell, valid, practice.

INTRODUCTION

Learning Media is one determinant of the success of the learning process. According Kustandi and Sutjipto (2011 : 9) " learning media is a tool that can help the learning process and serve to clarify the meaning of the message, so as to achieve the learning objectives with better and perfect ". This is in accordance with Danim opinion (2010: 7) states that media education is a set of tools that are used by educators in order to communicate with learners.

Learning media to help meet the needs of learners in the learning process because basically all learners doesn't have the same ability in absorbing learning materials. With the medium of learning, can optimize the learning process because students can learn independently according to their own pace. This depends on the type of instructional media and the needs of the students will be learning media types are suited to the circumstances and needs of learners.

Learning media disparate types, one of which is a module. Superman (2013 : 9) states that the module is one form of media that is packaged as a whole and systematically in which includes a set of learning experiences are planned and designed to help learners master the specific learning objectives. The learning objectives can be achieved by either rely on the implementation of the educational process.

Implementation of education in Indonesia is currently experiencing a period of transition curriculum, which is a change from the "Kurikulum Tingkat Satuan Pendidikan (KTSP) to Curriculum 2013. This change is considered necessary to adjust to the challenges of the times. Changes in the nature, attitude and behavior of students are one example of the waning of the nation's character that struck Indonesia's young generation. Education plays an important role in the formation of human resources. In line with the Indonesian educational purposes listed in the Act No. 20 of 2003 Section 3 states, "National education serves to develop the ability and character development and civilization of the nation's dignity in the context of the intellectual life of the nation, is aimed at developing students' potentials in order to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become citizens of a democratic and responsible "so that it can be understood that education aims to develop the intellectual, emotional and spiritual.

Implementation of education in Indonesia so far only emphasis on intellectual education alone and tend to disregard education will be full of norms and values. According Lufri (2010 : 127) during this education in the school focuses on the development of intellectual, that is absorbing as much knowledge but little touches emotional and spiritual intelligence.

Education nuanced Emotional, Spiritual Quotient (ESQ) is one alternative for achieving education will be full of norms and values. According Lufri (2010: 126-127) ESQ is a two intelligence of humans in addition to the intellectual or Intelligence quotient (IQ), emotional intelligence or emotional quotient (EQ) and spiritual intelligence or spiritual quotient (SQ). Therefore, the government is developing a curriculum in 2013 in which the integrated values of social attitudes and spiritual attitudes are listed on their core competencies and core competencies 1 2. Integrating the values ESQ in teaching and learning resources is expected to encourage an individual to behave and act wisely in the face of life's challenges.

Based on observations with the analysis of questionnaires and interviews with teachers and students on 29 September 2014 held at SMA Negeri 1 Kubung known that 85% of the 20 students of class XI IPA1 cheat on a friend when the exam takes place and only the remaining 15% who do not cheat. In another statement, showed that 40% of students in class XI IPA1 laugh at her when they made mistakes and 60% of them did. This suggests that the need to provide an understanding and teaching the values ESQ to learners in the learning process for students to change for the better. David (2012: 244) say, "Emotional intelligence relies on the connection between feelings, character, and moral instincts that include self-control, passion and perseverance, adaptability, ability to solve personal problems, anger control and the ability to motivate yourself, Especially in the learning process. In the learning process, there is a change in the capabilities of the learners in various fields, and the ability it acquired for their learning effort. Children who master their emotions become more confident, optimistic, have a spirit and ideals, have the ability to adapt as well as they would have been better performances in schools that are able to understand, as well as mastering the problems that exist "

Biology is a natural science is very complex because of the overall study of living things and their environment. One among the material is a cell biology, learning about the subjects listed in the cell biology class XI SMA / MA in Attachment Regulation of the Minister of Education and Culture No. 69 Year 2013.

The cell is the smallest unit of a living composer, the cell itself is formed by organic material. As a constituent of living beings and the demands of the need for the curriculum, it is necessary to integrate the values of emotional and spiritual in learning cells as a form of gratitude to the complexity of the creation of God Almighty.

In optimizing the learning process complex cells and includes the delivery values of the emotional and spiritual, one of which can be done by developing nuanced learning media ESQ. ESQ nuanced learning module development as well as to meet the needs of core competency, 1 and 2 in 2013 demanding curriculum of learning that shape the attitudes of spiritual and social attitudes of learners. It is also concerned with the observation of researchers with educators subjects SMA Negeri 1 Kubung biology and observations in the field who have not met their learning modules that incorporate spiritual values and attitudes of social attitudes in it.

Learning media should be able to attract the interest of learners. Lufri (2010: 18) states that "learning materials are designed to be attractive and easy to understand learners or communicated in simple language". Learning media in the form of different modules with instructional media or other instructional materials for the modules can be developed by using a selection of attractive colors, making it more motivating learners to use it in the learning process. Several previous studies have also proved that the module can attract learners.

Research Miansyah (2013) proved that the modules are equipped with color images and text gives the impression that appeal to learners that lead to motivation for learners to learn. Research Alfarisi (2013) prove that spiritual meanings presented in the learning module on material biology, reproductive system in humans makes learners to express a sense of comfort that acquired in the study modules. Research Fatma (2014) proved that nuance ESQ given in biology learning module on the material of the human circulatory system can attract learners in studying the circulatory system.

So far, there are no shades of the 2013 curriculum modules ESQ for the cellular material, so it is necessary to develop such modules are valid and practical. Based on these things, developed learning modules Emotional, Spiritual Quotient biological nuances of the cell material to high school students. The ESQ nuanced module is expected to help learners to understand the lessons and develop the potential within her personal knowledge to build knowledge and noble.

METHODOLOGY

This type of research is the development of research (Research and Development). This study aimed to produce a product, which is a nuanced ESQ learning module on cell material for high school students. This research was conducted in the Department of Biological Science UNP and in class XI IPA 1 SMA Negeri 1 lemur. The timing of the study is the month of September 2014 - January 2015.

The object of this study is a nuanced ESQ learning module on the cell material used in high school. The subjects were 2 lecturers UNP Department of Biological Science, 2 teachers and 20 students of SMA Negeri 1 Kubung. The research data come from questionnaires validity and practicalities. This data, including primary data, i.e. data obtained directly from the research subjects.

ESQ nuanced module was developed using three stages of 4-D models define phase (definition), design (design), develop (development).

1. The define phase
   In the define phase is done the determination of the terms of learning by analyzing core competencies, basic competencies, and the subject matter based on content standards, curriculum, 2013.
2. The design phase
   aims to prepare the module ESQ nuanced according to core competencies, basic competencies and learning objectives have been determined. At this stage it does is designing the module frame in the cell material based on the analysis at this stage of definition (define). There are three steps in this phase are: the selection of media, format selection and preliminary design.
3. The development phase

This stage aims to produce a learning device that has been revised by the expert or experts and has been tested against educators and learners. This stage includes the validity and test the practicalities.

Ratings validity following the modified criteria of Purwanto (2009: 82) as follows.

90% - 100% = Very valid.
80% - 89% = Valid.
60% - 79% = Enough valid.
0% - 59% = Not valid.

$$\text{Nilai Validitas} = \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor tertinggi}} \times 100\%$$

Analysis practicalities performed in the same manner with the analysis of the validity, but uses a modified assessment criteria of Purwanto (2009: 102-103) as follows.

90% - 100% = Very practice.
80% - 89% = Practice
65% - 79% = Enough practice.
55% - 64% = Less practice
0%-54% = Not practice

FINDINGS

1. Define Phase

a. Preliminary analysis

Based on the results of questionnaires that examine give to students SMA Negeri 1 Kubung class XI IPA1 on 29 September 2014 it is known that many learners are being dishonest during the exam because they ask answers to friends, but based on interviews note that all members of the class are Muslim, where Islam is not allowed to cheat in any activity.

One solution to these problems is the need to embed and provide an understanding of the values of emotional and spiritual to the learners. In line with this, SMA Negeri 1 Kubung that still applies the curriculum in 2013 need to cultivate emotional attitudes and spiritual in the learning process to meet the demands of one's core competence and core competencies 2.

In fact on the ground have not found the existence of teaching materials that give the feel ESQ in learning biology. One solution to these problems is developing learning module aimed at developing ESQ nuanced emotional and spiritual potential of learners, as well as helping learners to foster spiritual values expected.

b. Analysis of Students

Based on the analysis of learners through observation, note that in general the students sitting in class XI have ages ranging from 16-18 years. Trianto (2010: 197) states that according to Piaget's theory of learning, children aged 16-18 years are included in the formal operational stage. Learners are already capable of abstract thinking, able to analyze the problem, draw conclusions and find solutions for problems. All students who are in class XI IPA1 Muslims to the spiritual feel of the ESQ associated with verses of the Qur'an and hadith.

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c. Task analysis

The task analysis is more focused on the details of KI and KD for cell material which translated into indicators. analysis tasks can be either structural analysis of contents below.

Table II. Basic Competency Class XI SMA / MA.

Demention	Basic Conpetency
Spiritual	1.1 Admire the order and complexity of God's creation of the structure and function of cells, tissues, organs and Bioprocess system compiler that occur in living beings.
	1.2 Be aware of and admire the scientific thinking in the ability to observe the Bioprocess.
	1.3 Be sensitive and concerned about environmental issues, maintaining and caring for the environment as a manifestation of the practice of the teachings of their religion.
attitute	2.1. Behave scientific: conscientious, diligent, honest to data and facts, discipline, responsibility, and care in observation and experimentation, daring and polite in asking questions and arguing, environmental care, mutual aid, cooperation, love, peace, argues scientifically and critically, responsive and proactive in every action and in conducting observations and experiments in the classroom or laboratorium.
	2.1. Concerned for the safety of themselves and the environment by applying the principle of safety when conducting observations and experiments in the laboratory and in the surrounding environment.
Cognitive	3.1 Presenting models/ Charter / image that represents the understanding of the structure

Demention	Basic Conpetency
	and function of the cell as the smallest unit of life.
	3.2 Creating process models using a variety of media through the analysis of the results of the study of literature, microscopic observation, experiment, and simulation of Bioprocess which takes place in the cell.
Skill	4.1 Presenting models / Charter / images presented his understanding of the structure and function of the cell as the smallest unit of life.
	4.2 Creating process models using a variety of media through the analysis of the results of the study of literature, microscopic observation, experiment, and simulation of Bioprocess which takes place in the cell.

Tabel 2. indicators of competence

Demention	Basic Conpetency
Spiritual	1. Admire the complexity of God's creation of the structure and function of cells, as well as Bioprocess which takes place in the cell.
	2. Grateful for God's favor has been given in the form of the regularity of the structure and functions of cell organelles.
	3. Admire the ideas of scientists as science favors bestowed by God to human
attitute	4. Be diligent and thorough in searching and processing information obtained, either sourced from books, the Internet, and others.
	5. Concerned for the safety of others and the environment by being careful

Demention	Basic Conpetency
	in conducting surveillance activities in the environment and in the laboratory.
Cognitive	6. Describe the constituent chemical components of cells.
	7. Describe the structure and function of cell organelles.
	8. Analyzing the mechanism of passive transport through the cell membrane (diffusion and osmosis).
	9. Explain the active transport diagram.
Skill	10. Make models of animal cells or plant cells.
	11. Make Charta transport processes active / passive.

2. Design Phase

ESQ nuanced module development is made in accordance with step-by-step guide to the development of teaching materials that have been prepared by the Education Ministry. This module created by using Microsoft Office PowerPoint 2010 with the help of image processing applications such as Microsoft Office Picture Manager and Paint.

The ESQ nuanced module has several components, including instructions for using modules for educators and learners, understanding competencies, learning activities, scientific research, testing understanding comes with the answer key at the end of the module and space motivation. The following describes the characteristics of the module are designed nuanced ESQ.

a. Cover module

Cover module consists of the front cover and back cover of the module. The front cover identity module load module that includes the title of the module using WordArt Fill-Gradient Blue, Accent 1 is written with the kind Calibri (Body) size 96pt, nuanced writing ESQ by type Calibri (Body) size 18pt and the title of the material by KI and KD are writing the kind indezonefont - creative 80pt size. The cover is made with pastel colors that are expected to attract the interest of learners. Target modules created using WordArt Fill- Red, Accent 2, Warm Matte Bevel written with the kind Calibri (Body) 25pt size and given the kind Transform Text Effects Button. While the constituent modules made with WordArt Fill- Red, Accent 2, Warm Matte Bevel with a touch of purple and written with the kind Calibri (Body) size 25pt.

b. The Pfofile module

The profile module contains a brief description of the general idea of the modules developed. The title is written with 18 PT font Lucida Bright spaced 1, with capital letters colored in blue, with a white background, which was given a thick green striped box. While the explanation module section is written with 12 PT font Cambria spaces 1.

Each step scientific approach included a picture with explanations in the green striped box. Step scientific approach written with blue letters. In each section, the picture is included as one characteristic of modules developed. Profile page modules are colored blue background. The profile module contains a general description of the modules developed. The title of the profile module using the kind of writing Jurassic with 28pt size. Descriptions of the content that is loaded on the module using the writing type Calibri (Body) size 11pt.

c. Instructions for Use Module
Instructions on using this module contains instructions on using modules developed. Instructions on using this module consists of a manual for educators and guidance to learners. The title for the manual module is written with the kind of writing Jurassic with 28pt size comes with supporting pictures owl reading more interesting for students to read and to see instructions for use of the module.
d. Comprehension Competence
The comprehension section contains competence competencies that must be mastered learners after learning the material presented. The title on the understanding of the competency is written with the kind of writing Jurassic with 28pt size while competencies are presented in the table by writing the type Calibri (Body) spaced 11pt size of 1.25.
e. Learning activities
On learning activity sheets presented learning objectives that are expected to master by students after learning of the learning activities. Title learning activities written with the kind of writing Jurassic with 28pt size while the content is written by Calibri (Body) size 11pt with spaces 1.25. At each learning activity is preceded by preliminary apersepsi containing the material to be covered.
f. Metacognition
One part of this module is metacognition. On this sheet students are expected to think critically. Learners are given room to optimize his thoughts by writing things into question after studying the material and presented some of the questions that are likely to be thinking by learners.
g. Scientific research
Scientific research contains one or two research activities / experiments that can be done learners to better understand the concept of matter. Scientific research is given the majority of the blue color to distinguish with other contents contained in the module. The content written in a typeface Calibri (Body) size 11pt with 1.0 spacing.
h. Competence test
At the competency test presented several questions to measure how far the students' understanding of the material that has been presented. At the end of the competency test presented a check of understanding which is a tool to determine how much students' understanding of the material that has been studied based on the scale specified.
i. Self-Assessment and Peer Assessment Friend
Self-assessment and peer assessment contains a number of statements that should be answered by learners honestly. Display Self-assessment can be seen in Figure 19. The title is written with the kind of writing assessment Jurassic with 28pt size table while the content is written by Calibri (Body) size 11pt with 1.0 spacing.
j. Answer key
This module is the answer key at the end to help students who have difficulty in finding the right answers for their own learning at home. Answers include answers to

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the competence test 1 and 2 as well as the competency test integrated several questions.

3. Develop Phase

a. validity Module

Validity nuanced ESQ modules conducted by two lecturers of the Department of Biological Science UNP and two educators Biology SMAN 1 lemur using a questionnaire validity. Quick results the validity of the module can be seen in Table III below.

Table III. Validity of Test Results Module with Scientific Approach

No	Components assessment	The validation (%)	The criteria
1	Feasibility the contents of module	88,89	Valid
2	linguistic	81,94	Valid
3	presentation of the module	89,28	Valid
4	layout	85	Valid
	Mean	86,27	Valid

Validation results in Table III above shows the average value of 86.27% with a valid category. This indicates that the module that was developed was valued both in terms of feasibility aspects of content, language, presentation, as well as aspects layout. In its development, the module has been revised based on the suggestions given validator.

b. Module practicalities.

Test the practicalities of the module is done to 2 educators and 20 students through a questionnaire practicalities. The test results by educators practicalities briefly shown in Table IV below.

Table IV. Practicalities of Test Results Module by Educators

No	Components assessment	The practicalities (%)	The criteria
1	ease of use	80,00	Practice
2	Learning time	81,25	Practice
3	benefit	87,50	Practice
	Mean	82,95	Practice

Based on the above table can be explained that the practicalities of modules nuanced ESQ by educators is 82.92% with practical criteria. This suggests that the practical modules for use by educators as a teaching material in the seal material.

In addition to educators, also conducted to test the practicalities of learners. The test results are shown in Table V below.

Table V. Practicalities of Test Results Module by Students

No	Components assessment	The practicalities (%)	The criteria
1	ease of use	86,25	Practice
2	Learning time	83,13	Practice
3	benefit	87,65	Practice
	Mean	85,67	Practice

Based on the above table can be explained that the practicalities of modules nuanced ESQ by learners is 85.68% with practical criteria. This suggests that the practical modules to be used by learners in learning.

DISCUSSION

1. Validity Modules Nuance ESQ

Analysis of the data from the questionnaire module validation nuanced ESQ by lecturers and educators based on four components, namely the feasibility of the content, language, presentation, and layout The result showed that the module is considered valid by the value of 86.27%. The validity of this is the result of the average of the four components.

Judging from the contents of the feasibility, the module declared valid by the validator with an average value of 88.89%, which means that the material presented in the modules have been in accordance with the applicable curriculum is the curriculum in 2013, and in accordance with the demands of core competencies and core competencies which are translated into learning objectives.

Ministries of Education (2008: 8) states that the teaching materials developed must comply with the applicable curriculum. Validity criteria indicate that the material content of the module has been true so it will not cause errors in understanding, especially things that are conceptual. Nuance ESQ served is also associated with the material and in accordance with the level of development of learners.

Judging from the linguistic components, modules developed, including a valid category with an average value of 81.94%. Components of the language associated with the use of language that is clear and precise so as to avoid ambiguity for learners. Sadiman, et al (2012: 10) states that as a presenter and channeling messages, media can represent educators convey information accurately, clear and attractive.

In terms of presentation components, modules developed, including a valid category with an average value of 89.28%. This indicates that the module has to load indicator and clear learning objectives. Clarity in the presentation facilitates learners to absorb learning materials. According Sutirman (2013: 9) must contain learning modules are packaged into units small activities/specific, making it easier studied thoroughly. To that end, the module is presented in two specific learning activities to enable students to understand the material. The material in the module has been presented sequentially and in complete accordance with the demands of the indicator. The module also includes shades ESQ expected to motivate learners to act and behave towards the better. ESQ nuances can be found integrated directly on the material or the special served on the space motivation.

Judging from the visualization components, modules are declared valid by the experts with an average value of 85.00%. ESQ nuanced biology learning modules designed and developed is good and interesting include the shape and size of the corresponding letter, the picture presented interesting and relevant to the material, as well as the selection of appropriate color and attraction. In line with that proposed by Arsyad (2010: 93) that the use of visual media, use images to illustrate the difference concepts. Sudjana and Rival (2011: 25) states that in choosing colors for the purposes of teaching materials, necessary calculations as carefully as possible.

Overall the average value of the validity of the test results spiritual nuances module is 86.27% with a valid criteria. This proves that the modules developed in compliance with the fourth aspect of the validity test based on an assessment of the experts so that these modules can be used either as a medium of learning in class XI senior haigh school cells that touches on the intellectual, emotional, and spiritual**.**

2. Practicalities Module

Test the practicalities of the module is done after being validated by experts and carried out to educators and learners. In this test the practicalities involved two teachers and 20 students of class XI SMA 1 Kubung. From the analysis of the test results on the practicalities of learning modules biology nuanced ESQ by educators and learners is known that practically categorized modules with an average value of 82.92% and 85.68%.

In terms of ease of use, practical categorized modules developed by educators with an average value of 80.00% and by learners with an average value of 86.25%. This indicates that the module developed can be practical and easy to use. In the module has presented a clear usage instruction module so that teachers and students know the steps that must be implemented in learning, both in the classroom and learning independently at home.

In terms of the efficiency of learning time, ESQ nuanced module proven to be efficient when used in learning. This is evident from the test results by the practicalities of educators and learners stating practical with an average value of 81.25% and 83.13%. Practicality in terms of time, efficiency study shows that the module can be used in accordance with the speed of each user. In line with the proposed Sutirman (2013: 9) that serves as a means of learning modules that are self-contained, so that students can learn independently according to their own pace.

Overall, the results of questionnaire analysis of the validity and practicalities module spiritual nuances declared valid and practical and supportive learning the nuances ESQ. With the conclusion of this module can answer the problems in the waning social values and spiritual attitudes among learners and answer the demands of core competencies and core competencies 1 2 that has not been presented in teaching materials that the researchers found in the field. The module is expected to be used as a teaching material that can be used by educators and learners in learning either in school or at home.

CONCLUSIONS AND SUGGESTIONS

a. Conclution

Based on research that has been done, it can be concluded that:

1. Generated nuanced ESQ modules on the cell material to high school with an average value of 86.27% of the feasibility aspects of content, language, presentation, and layout thus classified as valid criteria.
2. Generated ESQ nuanced module on the cell material to high school with a value of 82.92% by educators and value of 85.68% by learners in terms of ease of use, time of learning and the benefits that belong to practical criteria.

B. Suggestions

Based on the research that has been done, the researchers suggest the following.

1. Educators and learners can use this module ESQ nuanced as a medium of learning on cell material as the material supporting the teaching and learning process.
2. Other researchers can conduct advanced research in the form of effectiveness test to determine the level of effectiveness of the use of this module in learning.

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Introducing Distributive Property of Multiplication by Using Structured Object for Grade Two Elementary Students

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Abstract

This research aimed to develop classroom activities that support students in learning Multiplication especially in distributive property of multiplication. Design research was chosen as an appropriate means to achieve this goal. An instructional activities are designed and developed based on the investigation of students' learning processes. Students' actual learning was compared with our conjectured in our Hypothetical Learning Trajectory (HLT). Around fifty-six students and two teachers in elementary school Indonesia (MIN 2 Palembang) involved in this research.The result of the teaching experiment showed that describing structured objects activity could stimulate students to see the configuration of objects, when students saw the configuration of objects. Through emergent modelling, students had idea to know the distributive property of multiplication. Based on the result, it is recommended to provide structured objects for students, let them to see its configuration and let them to mathematize it when they learn multiplication.

Keyword: Design research, Multiplication, Structured objects, Distributive property of Multiplication

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INTRODUCTION

Research Background

In Indonesia, the learning and teaching process of multiplication is still in mechanistic way, the teacher explains the mathematics operation and procedure, give some examples, and asks the pupils to do other similar problems (Armanto, 2002). The point for students in learning multiplication in mechanistic way is learning multiplication tables (Van den Hauvel-Panhuizen et al, 2001) and this is done by rote memorisation. The problem with this approach becomes clear in the following. Armanto (2002) found out in his research on an Indonesian class that most students (60% out of 42 students) had a lack of memorizing multiplication table. Furthermore the students memorize the multiplication table without any idea of its meaning. Memorizing multiplication facts without any idea behind, is not a productive way to learn multiplication as it does not give them a chance to exploit useful number relationships (Van den Hauvel-Panhuizen et al, 2001). According to Van Galen and Fosnot (2007), some of big ideas when students learn multiplication are the distributive property of multiplication and the commutative property of multiplication. These two ideas are related to make connection between one of the other(s) multiplication facts. These two ideas can be as backup strategies when students cannot memorizing the multiplication table.

When children learn arithmetic, it is essential that they not only learn number facts (such as multiplication tables) and algorithms but also develop a conceptual understanding of relevant underlying mathematical principles (Squire et al, 2004). Learning the "tables" by rattling them off repeatedly can obstruct the mastery of multiplication facts (TerHeege 1985). The students need a greater understanding of the process of multiplication as well as when and how to use the multiplication facts (Caron, 2007).

Consequently, it is important that students develop their understanding of multiplication. Many researchers (Gelman, 1972; Ginsburg, 1977; Hughes, 1981; Carpenter and Moser, 1984) have shown that children posses considerable mathematical understanding prior to any formal instruction and this understanding is derived from everyday situations to which the children have been exposed (Anghileri, 1989). This is also in line with the idea of Freudenthal (1991) that proposed the need to connect mathematics to reality with the students' everyday situation.

Research Question

Considering the situation that described before, this research is aimed to develop classroom activitiy that support students in learning multiplication especially distributive property of multiplication. In order to support the growing process of second graders' understanding of multiplication, this research tries to answer the following research question;

How can structured objects promote students to know about distributive property of multiplication?

RESEARCH FRAMEWORK

This chapter gives a theoretical framework that underlies this research. This theoretical framework was elaborated to construct groundwork of this research. Literature about multiplication especially distributive property of multiplication was studied to identify the basic concepts that are required to help students know about distributive property of multiplication. Moreover, this literature was useful in designing instructional activities. The theory affects this research by connecting the definitions and research experiences.

Distributive Property of Multiplication

None of the mathematical operations, not even addition and subtraction, is understood as spontaneously as multiplication (Freudenthal 1983). Traditionally, multiplication is introduced to students as a way to represent quantities of things that come in groups (Van Galen and Fosnot (2007). For example, someone has 3 bags of 6 candies. To know the total number of candies that someone has means that the students have to count now by group instead of one by one for an efficient count. This is difficult for the students because they have a different idea with the prior knowledge that they already learned (Dolk and Fosnot 2001). The prior knowledge that the students already learned is that number is used to represent a single unit, for example six represents six candies. But in this situation they have to consider six candies in one bag. They have to understand that six can simultaneously be one – one bag of six candies – furthermore they have in front of them three groups of six candies to count. This means that they have to unitize the unit which is called unitizing. Unitizing is thinking of group of things as a unit (Van Galen and Fosnot, 2007).

The idea of unitizing is a big idea in multiplication, because it underlies the developmental progression for multiplication. Schifter and Fosnot (1993) define big ideas as “the central, organizing ideas of mathematics – principle that define mathematical order” (stated in Dolk and Fosnot, 2007). These ideas are called “big” because they are critical to mathematics and because they are big leaps in the development of children reasoning.

Other big ideas when students learn multiplication are, according to Van Galen and Fosnot (2007), the distributive property of multiplication and the commutative property of multiplication. These two ideas are related to make connection between one of the other(s) multiplication facts. For example, in the distributive property of multiplication the students can know the product (8 x 5) by adding the product of (5 x 5) and (3 x 5), for commutative property of multiplication, the students do not need to calculate the product 5 x 8 if they already know 8 x 5 from the multiplication table of 5. These two ideas can be as backup strategies when students can not memorizing the multiplication table.

Multiplication can take the following appearances in contextual situation, such as group of varying types such as bags, boxes, and a rectangular pattern (Van den Hauvel-Panhuizen et al, 2001). These appearances are very important because they are underlying the basic structure of multiplication and they offer insight into the properties of multiplication which is important for calculation.

When students learn multiplication, Kroesbergen (2002) suggests that it is important to give students sequential stage in the instructional activities: concrete objects (e.g., beads, block), semi concrete (e.g., pictures, representation), and abstract (e.g., numerals, symbols), to help the students develop their understanding of multiplication. The purpose in giving the concrete objects, semi concrete and abstract, to the students is to make the instructional activities real and meaningful for them which is in line with one of the tenet of Realistic Mathematics Education (RME). In the present study, a sequence of instructional activities is developed to help students develop understanding of multiplication by using realistic mathematics education approach.

Realistic Mathematics Education

According to Freudenthal, in his book Revisiting Mathematics Education ; China Lecture (1991).

> Mathematics has arisen and arises through mathematising. Mathematising is mathematising something – something non-mathematical or something not yet mathematical enough, which need more, better, more refined, more perspicuous mathematising. Mathematising is mathematising reality, pieces of reality. Mathematising is didactically translated into reinventing, the reality to be mathematised is that of the learner, the reality into which the learner has been guided, and mathematising is the learner's own activity. (P.66)

To help students mathematize reality, the tenets of Realistic mathematics education (RME) offer clues and design heuristics that were also applied in this research.

Five Tenets of Realistic Mathematics Education

Realistic Mathematics Education (RME) has five tenets or principles (Treffers, (1987) in Gravemijer, K. Van den Hauvel, M &Streefland 1990) that were also applied in this research. The tenets and application in this research are (1)Constructions stimulated by concreteness.(2)Developing mathematical tools to move from concreteness to abstraction.(3)Stimulating free production and reflection(4)Stimulating the social activity of learning by interaction and (5)Intertwining learning strands in order to get mathematical material structured.

Emergent Modelling

The implementation of the second tenet of RME produced a sequence of models that supported students' acquisition of the basic concept of multiplication especially distributive property of multiplication. Emergent modelling asks for the best way to represent situation that the students can reinvent or develop their idea about the concept of mathematics (Gravemeijer, 2004*). That situation makes emergent modelling is one of the heuristics for realistic mathematics education in which Gravemeijer (1994) describes how *model-of* a situation can become *model-for* for more formal reasoning. There are four levels of emergent modelling. The levels of emergent modelling are shown in the following figure:

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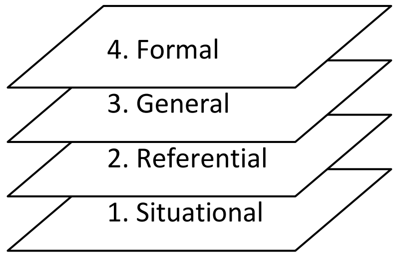


Levels of emergent modelling from situational to formal

The implementation of the four levels of emergent modelling in this research is described as follows;

1. Situational level

   Situational level is the basic level of emergent modelling. In this level domain specific, situational knowledge and strategies are used within the context of situation. In this research, we give the students situation for counting. We expect that the students could find efficient strategy to count such as counting in groups by using the structure of objects.

2. Referential level

   In this level models and strategy refers to situation that sketched on problems. This level also called *model-of*. A class discussion encourages students to shift from situational level to referential when students need to make representation (drawings) as the *model-of* their strategies to count the objects.

3. General level

   In this level, a mathematical focus on strategies that dominates the reference of the context, this is also called *models-for*. We expect students could see the structure of objects that supports their strategy to determine the total objects by repeated addition and transform into multiplication sentence.

4. Formal level

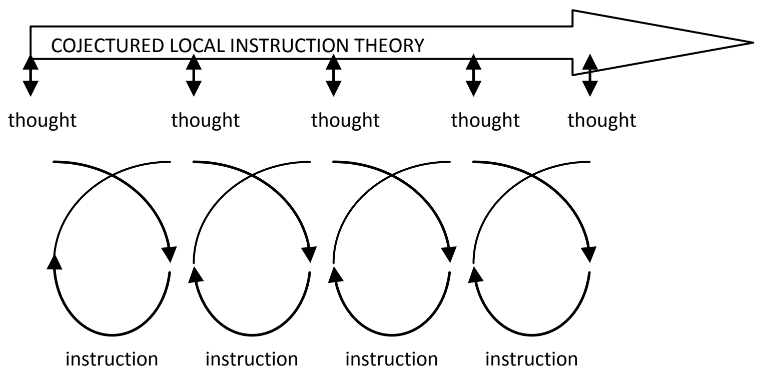
   In this level, students work with conventional procedures and notations. In this level the focus of discussion moves to more specifics of models related to the multiplication concept, for example,the students can know that 5x5 can be made from 5x3 plus 5x2.

RESEARCH METHODOLOGY

Design Research

This research was conducted under a design research methodology. The design research that we use, consist of cycles of three phases. They are;(1) A preparation and design phase, (2)A teaching experiment, and (3) A retrospective analysis.

In this phase, all collected data are analyzed. Our Hypothetical Learning Trajectory (HLT) is compared with students' actual learning. The exploration is refined to form a new cycle in the emergence of a local instructional theory as shown in figure below.



The cyclic process of design research(Gravemeijer& Cobb, 2006)

Research subjects

This research had been conducted in MIN 2, Palembang, Indonesia. This school is one of PMRI schools in Palembang. Min 2 Palembang has 4 classes for the second grade namely 2a, 2b, 2c and 2d. When students finished their study in grade one, all of the best students put in 2c and the rest spreads into 2a, 2b, and 2d. We conducted the experiment in two different classes, 2b and 2d, 2b class for preliminary experiment and 2d class for the experimental class. Those two classes consist of 26 to 28 students at the age of 8 to 9 years old. The students in those two classes had already learned about addition and subtraction in the domain up to hundred. The experiment of this research divided into two parts, preliminary experiment in order to see the conjecture works or not and teaching experiment. In the first part, we tested our HLT in 2b class. We want to investigate the students' thinking of the tasks and problems in the HLT and tested our conjectured about it. In the second part, we improved our initial HLT and then tested it in the 2d class.

Data Collection

In this study, the data such as video recording, students' works, and field noted were collected during the teaching experiments. We took videotape of the activities and interview some students. We analyzed the data from the video recording and students' works to improve our HLT.

HYPOTHETICAL LEARNING TRAJECTORY

In this research a learning trajectory is defined as a description of the path of learning activities that the students can follow to construct their knowledge about distributive property of multiplication, where in that path considers the learning goal, the learning activities and the conjecture of learning process. The learning trajectory is

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hypothetical because until we apply our design or until students really work in the problem, we can never be sure what they do or whether and how they construct new interpretations, ideas and strategies.

In this research a set of instructional activity for introducing distributive property of multiplication was designed. In learning multiplication, the second grade students follow the activity Counting dolls. Table below shows the general overview of hypothetical learning trajectory (HLT) of multiplication in Grade 2 students' elementary school for introducing distributive property of multiplication.

Counting dolls	▪ Counting structured objects ▪ Representing the number of objects in multiplication sentence	Students know about distributive property of multiplication.	▪ Distributive property of multiplication ▪ Part whole relationship	▪ Count the number of dolls in racks using repeated addition. ▪ Connecting the number of dolls if the rack were full with the number of dolls in rack and the empty space in rack.

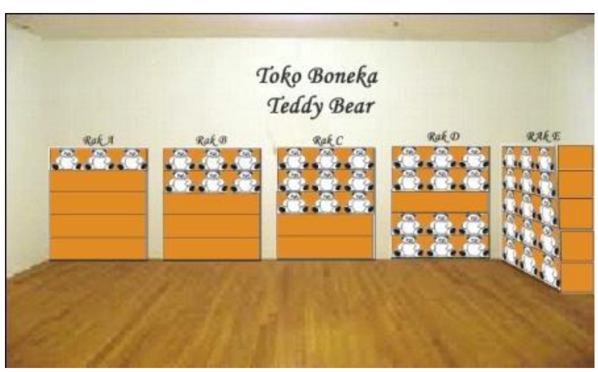
The hypothetical learning trajectory is elaborated in the instructional activity which called counting doll activity as following:

Learning goal: Students know distributive property of multiplication.

We want to make the students know about distributive property of multiplication. In order to do that, we gave the students pictures of dolls that arranged in the group of three in the five rows of rack (shelves). By using the context of doll store want the students realize that 5x3 can be solved by adding (1x3) and (4x3), or any combination of groups of three that add up to 5 groups.

Description of Activity:

In this activity the teacher shows picture of dolls in dolls store as shown in figure below.



Dolls in Doll Store

The students are asked to make connection among the full rack of doll, the number of dolls in the rack, and the number of dolls in empty space in the rack. The teacher could write (5x3) = (1x3) + (4x3) in the whiteboard and asks the students to give their comment on it. If the do not have idea, the teacher can guide them by asking to the students the number of dolls in the Rak(Rack) E, and how they get it. We expect that some students could answer that there are 15 dolls by adding 3+3+3+3+3. After that the teacher asks the students to represent the number of dolls in full rack in multiplication sentence. When they are able to represent the number of doll in Rak E in multiplication sentence, the teacher asks the students to look at Rak A, and asks how many dolls in Rak A, if that Rak were full of dolls. How many dolls in that Rak and How many dolls they need on order to make Rak A full of doll and tries to put in multiplication symbol as (5x3) = (1x3) + (4x3). After that the teacher gives the students worksheet to discuss in their group.

In the worksheet the students are asked to investigate Rak B, Rak C and Rak D. They have to make connection among the full Rak, the number of doll in the Rak and the number of doll in empty space in the Rak to find others combination of group of three that add up to five groups. After students finished their tasks, the class discussion is held. The students are asked to present their idea in the class and together the class gives comment on it.

Conjecture of students' thinking and discussion:

When the teacher asks to the students how many dolls in the Rak, most of students might count the number of dolls, one by one and get the quantity of dolls in the Rak. Some students might see the structure of the objects and count the total doll by the repeated addition because they see the number of dolls in each row is same. From the repeated addition they expected to be able to transform it into multiplication sentence because they had experienced with transform the repeated addition into multiplication in the activity 2.

When students able to represent the number of dolls in multiplication sentence, they have to make connection among the number of doll in the full Rak, the number of doll in the Rak and the number of doll in the empty space of the Rak and give their conclusion about it.

RETROSPECTIVE ANALYSIS

Teaching Experiment from "Counting Dolls Activity"

In the previous lesson, students already learn about one of the properties of multiplication. In this lesson students will learn about another property of multiplication, distributive property of multiplication. In order to do that, we gave the students pictures of dolls that arranged in the group of three in the five rows of rack (shelves). By using the context of doll store, we want the students realize that 5 × 3 can be solved by adding (1 × 3) and (4 × 3), or any combination of groups of three that add up to 5 groups.

The teacher started the lesson by showed the poster of dolls as showedto the students. The teacher asked to the students how many dolls in Rak E and together they answered 15 dolls. As our conjectured, some students got 15 from adding 3+3+3+3+3,

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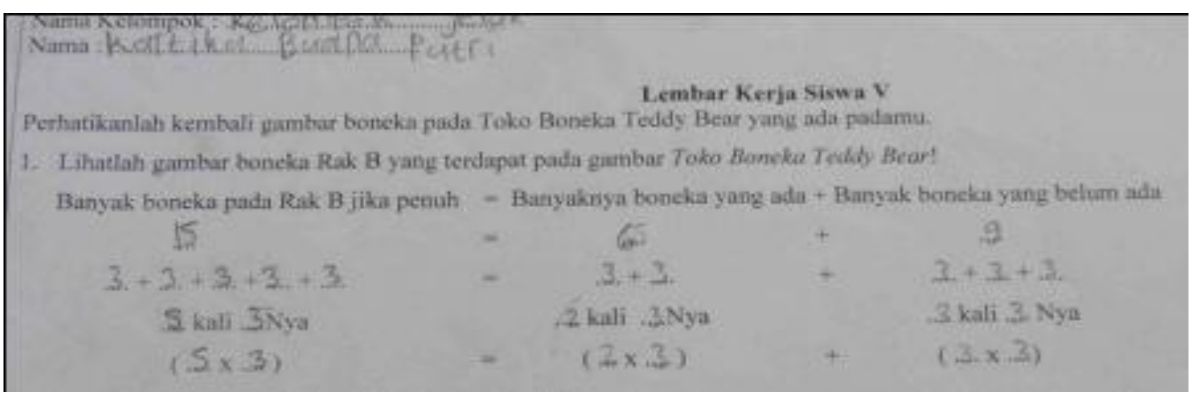
together with the students the teacher transform it into multiplication sentence. The following segment is a segment from our video recording.

Teacher	: Now look at Rak A, how many dolls in Rak A?
Students	: three
Teacher	: In order to make this Rak same with Rak E, or to make this Rak, full of dolls what should we do with the dolls?
Students	: We add teacher!
Teacher	: Ok, the number of dolls in Rak A adds with the number of dolls in empty space in Rak A. (the teacher wrote it in the whiteboard). Now, in order to make Rak A, full of doll how many dolls that we need to add?
Students	: Twelve.
Teacher	: How we add it?
Students	: three plus three plus tree plus three.

From the segment above, we analyzed that the teacher tried to guide the students to make connection among full Rak, the number of dolls in Rak and the number of dolls in empty space that to make the Rak full of dolls. The students knew that they needed to add the dolls in the Rak to make the Rak full of dolls, they added the number of dolls by adding 3+3+3+3 then they transformed it as 4 × 3. After that the teacher tried to make connection among the number of doll if the Rak were full of dolls, with the number of doll in the Rak and the number of that they needed to add. The teacher together with the students tried to conclude that they can construct (5 × 3) by adding (1 × 3) the number of dolls in the Rak, plus (4 × 3) the number of dolls that they needed to add.

After the teacher gave conclusion that they can make (5 × 3) from adding (1 × 3) and (4 × 3) by showed from the poster of dolls in Rak a, the teacher asked the students to work in group to do the worksheet to investigate that number of dolls in another Rak. When they finished, some of the students are asked to present their idea in front of the class.

Kartika, one of the students from Jeruk group, wanted to present their idea in front of the class. She wrote what she did in the worksheet to the whiteboard as shown in figure below.


Lembar Kerja Siswa V

Perhatikanlah kembali gambar boneka pada Toko Boneka Teddy Bear yang ada padamu.

1. Lihatlah gambar boneka Rak B yang terdapat pada gambar *Toko Boneka Teddy Bear*!

Banyak boneka pada Rak B jika penuh	=	Banyaknya boneka yang ada	+	Banyak boneka yang belum ada
15	=	6	+	9
3 + 3 + 3 + 3 + 3	=	3 + 3	+	3 + 3 + 3
5 kali 3Nya		2 kali 3Nya		3 kali 3 Nya
(5 x 3)	=	(2 x 3)	+	(3 x 3)

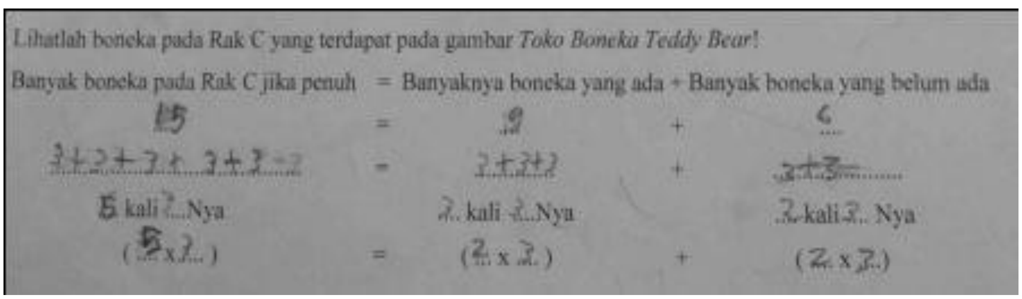
Kartika’s works

After she finished the teacher asked to the class if they have comment or questions to Kartika as describe in following segment:

Teacher : Ok, who wanted to give comment on the things that Kartika have been written in the whiteboard?
(Siska raised her hand, and come to the whiteboard and asked)
Siska : Where did you get the 6 here?(pointing to the number 6 that Kartika wrote.
Teacher : Ok class, Siska asked Kartika, where she got 6. Ok Kartika please explain to your friends.
Kartika : The six from the dolls in Rak B (pointing the dolls in Rak B in the poster)

From the segment and from Kartika's work, we analyzed that Kartika can explain that she got the number six from the picture of dolls in Rak B, then from the picture she got six from add 3+3 then she transformed it into multiplication sentence 2 × 3. She knew that she needed add 9 more dolls to make the Rak B full of dolls, she got 9 by adding 3+3+3 and she put in word 3 times of the 3 and put it in multiplication sentence 3 × 3. She can conclude that (5 × 3) = (2 × 3) + (3 × 3).

Adjie, one student from Anggur group, also wanted to present her work in the class discussion. In the class, he went to the whiteboard and wrote his finding. Adjie's work showed in following figure below.


Lihatlah boneka pada Rak C yang terdapat pada gambar *Toko Boneka Teddy Bear*!

Banyak boneka pada Rak C jika penuh = Banyaknya boneka yang ada + Banyak boneka yang belum ada

15 = 9 + 6

3+3+3+3+3 = 3+3+3 + 3+3

5 kali 3 Nya = 2 kali 3 Nya + 2 kali 3 Nya

(5 x 3) = (2 x 3) + (2 x 3)

Adjie's works

Adjie wrote what he had in the worksheet in the whiteboard, in order to save times the teacher helped Adjie to write Adjie's works. After finished, the teacher asked the students if they had question to Adjie. The teacher tried to provoke the students to pay attention to the multiplication symbol 2 × 3 that Adjie got from 3+3+3. The students complained that it was 3 × 3 not 2 × 3. The teacher asked another student from Anggur group to help Adjie, Ade come to help Adjie, Ade explained that they got nine from the number of dolls in Rak C, he knew it was nine from 3+3+3 which is he can change into 3 × 3 not 2 × 3, he gave reason that Adjie miss typed to write the multiplication symbol.

From Adjie's work, we can see that class discussion gave students an opportunity to justify their answers. It let the students to discuss and to find the solution. The teacher let the students to decide whether their friend work correct or not by posing question whether they agreed or not and asked their reason why they did not agree and gave their solution.

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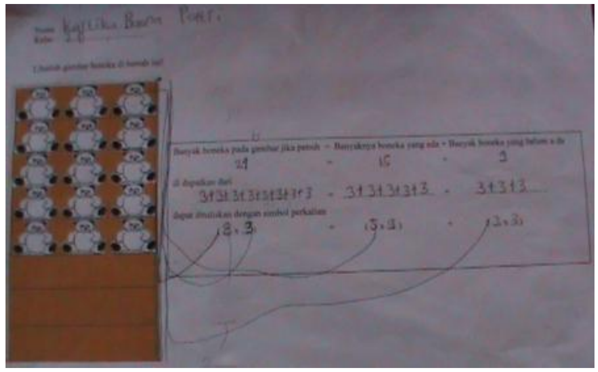
In order to know about students thinking, we gave the students worksheet and we interviewed them. Figure showed Kartika's works.



Kartika's works of counting dolls worksheet

From figure 65 we can see that Kartika able to represent the repeated addition that she made into multiplication sentence. The relation among full Rak and the number of dolls in the Rak and the number of dolls in empty space in the Rak, leads her to the conclusion 8 × 3 = (5 × 3) + (3 × 3). In order to know how she got it we interviewed her. The following segment is a segment from our video recording:

Researcher : Why do you made, eight times three (8 × 3) is equal with fives times there (5 × 3) plus three times three (3 × 3)?
Kartika : Can I make a stretch here? (She wanted to make illustration)
Researcher : Yes, of course
Kartika : Because the 8 is from these Rak (she gave mark for 8 rows of the Rak) and the 3 is from the dolls
Researcher : Ok, from the number of dolls in each row and then why it can be these (pointing to 5 × 3 that she made) plus these (pointing to 3 × 3 that she made).
Kartika : The fives (take a line from the fives in 5 × 3 that she made), from the number of dolls in this Rak (make a line in five row in the picture). While this three (take a line from the 3 in 3 × 3 that she made) from this (make a line in three row of empty space in picture)

From the segment above, we analyzed that Kartika involved part whole relationship to understand why she can construct (8 × 3) = (5 × 3) + (3 × 3). She explained that 8 × 3 is a whole by giving the line in 8 rows of the Rak. She tried to explain that she can make the whole by adding two parts of that (5 × 3) and (3 × 3).

Throughout this lesson, we concluded that by structuring the problem to the students and let them to make the relation between one to the others multiplication facts that they had can help the students to know about distributive property of multiplication. Through this lesson students can realize that they can construct 5×3 from (1 × 3) and (4 × 3), or from (2 × 3) and (3 × 3) from the context that we gave to them.

CONCLUSION AND RECOMMENDATION

Conclusion

This chapter presents the conclusion of the research findings in relation to the research question and recommendation for further studies. To answer our research question, '*How can structured objects promote students to know about distributive property of multiplication?'*we looked at learning activity and investigate what role of the structured objects serve in each sequence of students' learning. After that we can

After students are able to represent the repeated addition as multiplication sentence, understanding the property of multiplication became important parts. This research shows that structuring the objects and let the students to make the connection between one and the others multiplication facts lead the students to the property of multiplication such as distributive property However they needed more activity to explore those properties of multiplication.

Recommendations

This section would like to give recommendation about RME approach in the classroom, about teaching multiplication in grade 2, and suggestion for further studies.

Realistic mathematics education.

In our RME classroom, the contexts plays important role to stimulate the thinking process of students. The students could bring their informal knowledge to get ideas in solving mathematics problems. One of the contexts that can be used when students learning multiplication is describing structured objects to who cannot see the objects. This context can provoke the students to investigate the configuration of objects, which provokes the students to count in groups. This situation leads them to the idea of multiplication. But the most important is providing the situation for students to count since multiplication is a counting processes.

The contributions from the students are highly expected in the class. Stimulating the social interaction among the students in order to make them learned from each others solutions in the class discussion became one of important parts. Giving the freedom to the students to present their idea, and let them together to decide whether the problem that they are solved correct or not could stimulate the free production and reflection. Therefore we recommended the teacher to develop socio-mathematics norms like that.

Multiplication

In Indonesia primary school, in the first time students learn about multiplication, they are directly got repeated addition which is transformed into multiplication with an equal sign. Students had to memorize the multiplication table without any idea what is that. This research shows that multiplication is a counting process for students. This finding support the previous work from Coney et al (1988) that the acquisition of multiplication for students starts with counting process, not just a memorizing table. Students need sequences of activity to get insight into multiplication.

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THE EFFECT OF PROBLEM SOLVING STRATEGY ON MATHEMATICS LEARNING TO JUNIOR HIGH STUDENT'S MATHEMATICAL PROBLEM SOLVING ABILITY

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Abstract

The aim of this study is to determine the effect of problem solving strategy on mathematics learning to junior high student's mathematical problem solving ability. This study was conducted in SMP Negeri 26 Pekanbaru on academic year 2015/2016. This is a pre-experimental study which using the static-group comparison design. The population was all of students at grade IX in SMP Negeri 26 Pekanbaru and the number of sample in this study was 75 students. The sample was determined by using purposive sampling and random sampling technique. Class IX.4 consisting of 36 students was used as control class and class IX.6 consisting of 39 students was used as experimental class. The problem solving strategy was implemented at experimental class, meanwhile the conventional learning was implemented at control class. The data in this study was collected by using observation, test and documentation technique. The data consisted of qualitative and quantitative data. The qualitative data was collected by using observation, meanwhile the quantitative data was collected by using score of posttest. The data analyzed showed that the problem solving strategy on mathematics learning increased the mathematical problem solving ability of students at class IX in SMP Negeri 26 Pekanbaru. The number of that effect is 50,83% on medium level.

Key Words: *Problem Solving Strategy, Mathematics Learning, Mathematical Problem Solving Ability*

INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, having the important roles on various disciplines and encouraging the potency of human's thought (Depdiknas, 2006). One of the mathematics goal at level elementary and high education is the students must have the problem solving ability consisting of understanding the problem, devising a mathematical model, solving the model and interpreting the solution. The importance of mathematical problem solving ability is in line with the expected goal by the National Council of Teachers of Mathematics (NCTM). NCTM (2000) states that solving problem is not only a goal of learning mathematics, but also a major means of doing so. Generally, problem solving ability can be transferred to be used on solving other problems or making decisions. This ability requires the mindset involving critical thinking, systematic, logic and creative.

Based on the above description, it is clear that the mathematical problem solving ability is one of the learning orientations of mathematics in Indonesia even in the world. One of the international survey which assessing the mathematical problem solving ability is TIMSS (Trends International Mathematics and Science Study). In 2011, the ranking of Indonesia was the 38th of 42 participated countries with average score 406 while the international average score was 500 (TIMSS and PIRLS, 2012). This result is almost same with the result of Programmne for International Student Assessment (PISA) survey. In 2012, the ranking of Indonesia was the 64th of 65 participated countries with average math score 375 while the international average score was 494 (Fitri, 2013). It shows that Indonesia have the below ranking in the international study of TIMSS and PISA.

Furthermore, mathematical problem solving ability of students in Indonesia can be observed from the score of mathematics national exam. In 2015, the average score of national exam of junior high students declined 4.73 compared in 2014. The average score in 2014 was 61.00 and in 2015 fell to 56.27. This decline is caused because the problems on national exam in 2015 were arranged toward the problem requiring the higher thinking ability as well as the problem on TIMSS (Luki Aulia, 2015). The decline of average score of mathematics national exam is also occurred in Riau province. The average in 2014 was 69.2 and in 2015 fell to 62.39 (Kemendikbud, 2015). Based on the data obtained by researchers at one of the schools in the province of Riau, SMP 26 Pekanbaru, the average score of the national exam in 2015 also decreased 1.20 compared in 2014. The average score of national exam in 2014 was 77.70 while in 2015 fell to 76.50. Based on these data, the lack of mathematical problem solving ability of junior high students is caused by many factors. One of the contributing factor may be observed on the activities learning by teachers at school.

Based on observation at SMP 26 Pekanbaru, the teacher did not facilitate the students optimally about the ability of mathematical problem solving. Teacher only explained the material, gave examples and solved problems without teaching how to solve the problems, meanwhile the taught basic competency demanded students to solve the problem. Problem solving ability is a skill needed to be taught and the mathematics teachers should make an effort to teach it (Lenchner in Sri Wardhani, et al., 2010). One of that efforts is by implementing Polya problem solving strategy.

Generally, the strategy of problem solving according to Polya (2014) includes four steps. The steps are: (1) Understanding the problem, (2) Devising a plan, (3) Carrying out the plan, and (4) Looking back. On the process of problem solving, these steps must be trained by teachers to students to train their ability on mathematical problem solving. In addition the students must also be skilled to create their own specific problem-solving strategies.

The specific strategy of problem solving is a specific strategy made by students to train their ability on solving various problems. Some specific strategies solving the problem that has been modified by Holmes (in Sri Wardhani, et al., 2010) are creating picture or diagrams, discovering patterns, making the organized list, creating tables, simplifying the problem, trying, doing experiment, demonstrating the problem, moving from the back, writing an equation and using induction.

Based on the analysis of the above problems, the researchers find the problem on mathematics learning. The problem is the students at JHS (Junior High School) 26 Pekanbaru had the low mathematical problem-solving ability and teachers did not teach the problem solving ability optimally. The teacher should make an effort to facilitate the students on solving problem and the effort is by implementing Polya problem solving strategy. To determine the effect of problem solving strategy implementation on mathematics learning to the mathematical problem solving ability of students, the research carried out on the basic competence containing the operational word solving the problem. One of the basic competency at grade IX is Basic Competency (BC) 1.3 "Using the concept of triangle congruency on problem solving".

This study involved two groups. The groups were the experimental group received the implementation of problem solving strategy and control group received conventional learning. The specific strategy used in problem solving of this study is making picture or diagram. The purpose of this study was to determine whether the implementation of problem solving strategy on mathematics learning gives the effect to mathematical problem solving ability of students in grade IX at JHS 26 Pekanbaru.

RESEARCH METHOD

The research was conducted on the academic year 2015/2016 at JHS 26 Pekanbaru. This study was an experimental study with the type specifications is pre-experimental study. Basically, this study aims to determine the effect of the implementation of problem solving strategy on mathematics learning to the mathematical problem solving ability of students by manipulating the independent variable ‘problem solving strategy’, while the dependent variable is mathematical problem solving ability of students.

The experimental design used in this study is the Static-Group Comparison Design. This design used two sample groups, namely the experimental group and control group. The experimental group received treatment ‘the implementation of problem solving strategy in mathematics learning’ (X1), while the control group received standard treatment ‘conventional learning’ (X2). After being given the treatment, both groups were given postes (O).

The population were all students at grade IX and the samples are students at class IX.4 as the control class and class IX.6 as the experimental class. The data in this study was collected by using observation, test and documentation technique. The data consisted of qualitative and quantitative data. The qualitative data was collected by using observation, meanwhile the quantitative data was collected by using score of posttest. The technique of data analyzed consists of data analyzed before treatment, data analyzed after treatment, and hypothesis testing.

The data analyzed before treatment is about selecting sample. The data was analyzed by using purposive and random sampling and it was tested by using normality test, homogenity test and independent sample t test. The data analyzed after treatment is about analyzing score of posttest. It was tested by using normality test and homogenity test. The hypothesis testing is analyzed by using independent sample t test of posttest score.

RESEARCH FINDING

The data analyzed before treatment is about selecting sample. The data was taken of the test of students before treatment on subject matter congruency including BC 1.1 "Identifying the congruent or similar plane figure" and BC 1.2 "Identifying the properties of two triangles which are congruent and similar". The population is all students at grade IX consisting of class IX_1, IX_2, IX_3, IX_4, IX_5, IX_6 and IX_7. Each class consists of 40 students. By using purposive sampling, the choosen classes are IX_4, IX_5, IX_6 and IX_7. The data analyzed before treatment was tested by using normality test, homogenity test and independent sample t test. The result of normality test based on the significant score is IX.4 (0.067), IX.5 (0.014), IX.6 (0.240) and IX.7 (0.038). It shows that the score of sig. class IX.4 and IX.6 are greater than α (α=0.05). It means that class IX.4 and IX.6 have normal distribution. Homogenity test is only done to the class having normal distribution. The result of homogenity test based on the significant score is 0.431. The score is greater than α (α=0.05), so the data before treatment of two class is homogeny. Then the test of two means similarity is done by using independent sample t test. The result of two means similarity test shows that $\mathbf{t}_{\text{calculation}}$ (1,473) < $\mathbf{t}_{\text{table}}$ (1,991). It means that there is no difference between two means of class, so the mathematical ability of students at two classes is equal. By using random sampling, class IX.4 as control class and class IX.6 as experimental class. The number of students following all activities at class IX.4 and IX.6 are 36 students and 39 students. Then the number of sample in this study is 75 students.

The data analyzed after treatment is the analysis of posttest score. This analyzed data was initiated by using the statistical prerequisites consisting of normality test and homogenity test. The result of normality test based on the significant score is experimental class (0.097) and control class (0.289). It shows that the score of sig. experimental class and control class are greater than α (α=0.05). It means that both classes have normal distribution. The result of homogenity test based on the significant score is 0. 358. The score is greater than α (α=0.05), so the posttest score of two class is homogeny. Then the hyphotesis test is done by using right side of two means difference t test. The result shows that the score $\mathbf{t}_{\text{calculation}}$ (6,042) > $\mathbf{t}_{\text{table}}$ (1,666), then the average score of experimental class is better than control class. It can be concluded that the implementation of problem solving strategy on mathematics learning gives the effect to mathematical problem solving ability of students in class IX at JHS 26 Pekanbaru. The number of difference because the effect of implementation of problem solving strategy on mathematics learning to mathematical problem solving ability of students in class IX at JHS 26 Pekanbaru is 50.83% or in the medium category. The detailed data posttest of each indicator of mathematical problem solving ability of students can be seen in this following table.

Table 1. The score of each indicator of mathematical problem solving ability

No	Indicator	Average		Difference
		Eksperiment	Control	
1	Ability to understand problem	94.1	24.36	69.7
2	Ability to devise plan (diagram)	84.55	73.18	11.54
3	Ability to carry out the plan	82.23	76.12	6.11
4	Ability to look back	79.51	5.77	73.74

Based on the above table, the average score on each indicator of experimental class is always higher than the average score of control class. That's way the problem solving ability of students at experimental class is better than control class.

On understanding problem indicator, the average posttest score of students at experimental class is 94.10, meanwhile the average posttest score of students at control class is 24.36. The students at experimental class understand the problem by writing what is known and what is asked from the problem correctly and appropriately. It means that the ability to understand the problem of students at experimental class is better than control class. The average posttest score of students at experimental class is 84.55, meanwhile the average posttest score of students at control class is 73.18 on devising plan indicator. The students must make the specific strategy by making diagram in this step. This strategy helps students to understand and find the way to get the solution generally. The students at experimental class are able to make the diagram from the problem correctly and appropriately. So that, the ability to devise plan of students at experimental class is better than control class. On carrying out the plan indicator, the the average posttest score of students at experimental class is 82.23, meanwhile the average posttest score of students at control class is 76.12. The students implements the plan and doing the calculation to find the solution in this step. The students at experimental class do the calculation in stages accurately and correctly. It means that the ability to carry out the problem of students at experimental class is better than control class. The average posttest score of students at experimental class is 79.51, meanwhile the average posttest score of students at control class is 5.77 on looking back indicator. The students reanalyze and evaluate their solution by making the conclusion in this step. The students at experimental class are able to interpret the solution and making conclusion correctly and appropriately. It means that the ability to look back of students at experimental class is better than control class.

In addition, the table 4.7 also showed that the average posttest score of students in the experimental class decreases from first indicator to fourth indicator. Score of the ability to understand the problem is 94.10, score of the ability to devise plan is 84.55, score of ability to carry out plan is 82.23, and score of ability to look back is 79.51. It is becaused the students have lack of carefulness on understanding the problem, then it may affect to devise the plan. After that, when carrying out the plan, the solution is not appropriate, then the conclusion is incorrect. Therefore, each indicator of problem solving ability has interdependent, thus the carefulness of students is very important on solving the problem.

CONCLUSION

Based on the formula of the problem and the research finding that has been presented, it can be concluded that the implementation of problem solving strategy on mathematics learning gives the effect to mathematical problem solving ability of students in class IX at JHS 26 Pekanbaru

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DEVELOPING LEARNING MODEL BASE ON REALISTIC MATHEMATICS EDUCATION (RME) APPROACH AT SENIOR HIGH SCHOOL

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Abstract

Many students have low achievement in math, it could see from daily exam, national examination, or TIMSS' skors. it can be caused by many factors, one of them isunefectivenes of teaching procces in the class, passive students, or lesson materials. In this reseach, the development of learning model are developlesson plan and lesson material base on realistic mathematic education (RME). The purposes of this research is to produce valid, practical, and effective learning model based on RME. Type of this research is reasear development using plomp model that consist of preliminary research, development or prototype phase and the assessment phase. In a preliminary research, researcher conducted needs analysis, model of teaching analysis, student's analysis and problem analysis in learning mathematics. In developing or prototype phase, the researcher made a learning model, lesson plan and lesson material base on RME. Learning model, lesson plan and lesson materialare validated by three experts of mathematic education, educational technology expert and expert of Indonesian language. Practicality is seenfrom through the results of analysis of the implementation of learning observation sheet, interview and questionnaire responses for students and teachers. Effectiveness can be seen through the observation and analysis of the activity of student learning outcomes.
Keywords: learning Model, Realistic Mathemathic Education.

INTRODUCTION

Providing education as mandated in constitution no. 20 on 2003 about national education is expected to create the development process of learner personal quality as young generation which is believed will be the determine factors of Indonesian development for ages. In line with the directive of its constitution, education vision 2025 has been set which is creating smart and creative Indonesian people. Intelligent comprehensive is spiritually and social/emotionally intelligence in attitude, intellectual and knowledge also kinesthetic skills. Thus, 2013 curriculum was designed in order to prepare the Indonesian generation that have the ability to live as a person and a citizen who believed, productive, creative, innovative, and effective and able to contribute to the life of society, nation, state and world civilization.

In process standard, teachers' skills in teaching is badly needed, teaching skills is a complex professional competence as an integrated of variety teacher competences completely and thoroughly. Turkey (Tanieredja, Faridli, et.all:2011), there are eight teaching competences which has contribution and determine the teaching quality which includes questioning skills, provide reinforcement, teaching variation, explained, opening and closing the lessons, guided small group discussions, classroom management, as well as teaching small groups and individuals.

The facts above show that the role of a teacher is really need in learning design and linking elements in the leaning process. According to Rusman (2011) learning is a process of interaction of learners, teacher and learning resources in a learning environment, and learning needs to be planned , implemented, assessed, and monitored in order to run effectively and efficiently.

Students' understanding in mathematics material is closely related with students' test scores. Students' score in math especially high school students are generally low. It can be seen from the achievements of the national exam (UN) in some areas, especially Dharmasraya, with rate occupying almost the last of the 19 districts and cities in West Sumatra.Internationally, the low achievement of students' mathematics score also can be seen in a study conducted by Trends in International Mathematics and Science Study (TIMSS 2011) the percentage of Indonesian students who reach the level of low, medium, high and expert in science in a row is 54% , 19%, 3% and 0%. In the mathematics, these percentages are respectively 43%, 15%, 2% and 0%.

Researcher observation in several high schools at Dharmasraya shows that there are several factors cause this case. The first factor is the learning process is dominated with teacher center. Second is learning method. Teachers mostly used discussion, lecturing and class discussion. The use of method which make students actively learn is rarely use. Third is students' side. Based on the observation, from the 32 students, there only 15.6% students who like math, 34.4% neutral and the others does not like math. 84.4% students thought that math is difficult with full of dizzying figures, monotonous.Fourth is material and learning strategy. Mathematic material is mostly abstract and full of content; also there is only a few media that can be used in math.The last is the sources. There is only a few books as sources that can be borrowed to the students. The few list of mathematics sources that make teachers hard to make an analogy of mathematics in daily life.

The low students' score was certain problem for teacher and most of them thought that their major is uninterested lesson for students. Thus, learning process of mathematics should be changed into an interested lesson for students. Math should be a fun humanistic learning, it starts from solve a realistic mathematics problem. By solving a math problem which found in real life will build students' concept and understanding about mathematics. Besides, discussing and teachers' help also help students to understanding math better.

Besides mathematization of everyday experience, students also have a chance to concept mathematization, notation, model, procedure, and other math problems solving. As human activities, math matery should be found by students itself. They learn built the model (formal and informal) based on the questions that given. At last students will built their brain storming about mathematics. By giving a chance to students to answer mathematics test in daily life with their own understanding will build new understanding about the concept and the operation of math.

Based on the explanation above, researcher interested to conduct a research which will help students to solve learning problems by develop learning model in mathematics by using PMR. PMR is completed with guidance book for teacher and students' book. Therefore, researcher conduct a research entitled "The Development of Mathematics Learning Model based Realistic Mathematics Education Approach for Senior High School" as a solution to solve students' problem in learning mathematics.

MATERIAL AND METHODS

Some education experts define contextual learning with a concept of learning that helps teachers link between the materials and encourage students to make connections between the knowledge possessed by the application in their daily lives. by the involveving the seven main components of effective learning that is constructivism, questions, find, learning community, modeling, and authentic assessment (Nurhadi, 2005). Suherman (2003) stated that learning with contextual approach is the learning that takes (stimulate, communicating the dialogue, or the answer and questioning) the events in the real life experienced by students and then lifted into concepts that are discussed.

Contextual learning can be regarded as a learning approach that recognizes and shows the natural conditions of knowledge. Through relationships inside and outside the classroom, a contextual learning approach makes the experience more relevant and meaningful to students build knowledge that they will apply in lifelong learning. Contextual learning presents a concept linking the material that students are studying in the context of the material used, and the correlation between someone learning way or how students learn.

Thus, in the learning activities is need an effort to learning easier, simple, meaningful and enjoyable that make students easily accept the idea, understand the problems and can construct their own knowledge actively, creatively and productively. In order to achieve these efforts all learning components to be considered included contextual approach.

In relation with the evaluation, contextual learning with more emphasis on authentic assessment obtained from a variety of activities. Alwasih, Chaedar (2002) argues that the benefits of authentic assessment for students among others: (1) revealed a total of how well understanding of academic material are, (2) express and strengthen control of their competencies such as collecting information, use of resources, explore technology, and think systematically, (3) connecting learning to their own experiences, their world, and the wider community, (4) sharpen the thinking skills in the higher level in analyze, integrate, identify problems, find solutions, and connect cause and effect, (5) accepting responsibility and making choices, (6) associated and cooperate with others in doing the task, and (7) learn to evaluate the level of their own achievement.

The learning model is a plan or a pattern which is used as a guide in the classroom learning or learning in the tutorial. The learning model has a broader meaning (Trianto, 2009). Joyce and Weil (2009) states that: "Models of teaching are rarely models of learning. As we help the student acquire information, ideas, skills, values, ways of thinking and means of expressing Themselves, Also we are teaching them how to learn ". This means that the learning model is a model of learning, with the model, teachers can help students to acquire or obtain information, ideas, skills, ways of thinking and expressing ideas themselves, besides they teach them how they learn.

Every model directed us to design learning which can help students to achieve various objectives. As the opinion of Joyce (2009): "The model of teaching is a plan or pattern that we can use to design a face-to-face teaching in the classroom or tutorial setting and to shape instructional material Including books, films, tapes, computer mediated programs, and curricula (long-term courses of study). Each models of guides us as we design instruction to help student Achieve various objectives ".

The learning model is built and reconstructed by several components. Joyce and Weil (2009) suggests five essential elements that the condition for learning model. The fifth component is the syntax, the social system, the principles of reaction, and the effects of instructional support system and companion. The fifth element will be described as below. **The syntax** is a sequence of activities or phases or steps in learning. The sequence of activities or phases or stages in the learning will occur guide for educators or teachers as well as learners or students in carrying out the process of learning; **social systems** is the description of the role and relationship between educator (teacher) and learners (students) and the bases rules; **principle** is the reaction will explain how a teacher appreciation, placing and respond to what students has done; **support systems** are devices that support the implementation of learning. And **the effects of instructional support system and companion**, this effect is distinguished on the impact of direct influence (direct) and indirect (indirect) experienced learners when learning model application. The direct effect is the effect of instructional and indirect effect is the effect accompanist. Instructional effect refers to the learning outcomes and the effect of a companion reference to the experience or skills acquired by the students.

PMR is an approach of learning that is adapted from Realistic Mathematics Education (RME) learning. RME according to Gravemeijer (1994) is a theory of teaching and learning in mathematics education. RME theory was first introduced and developed in the Netherlands in 1970 by the Institute Freudenthal, this theory refers to the views Freudenthal (2002) about the mathematics, which is 'mathematics must be connected to reality and mathematic as human reality'. First, mathematics should be close to the students and should be relevant to daily life situations. Secondly, he emphasized that mathematics as a human activity, so students should be given the opportunity to learn to perform activities of all the topics in mathematics.

Realistic mathematics learning focuses on mathematics learning in the lives of students outside of school, it is intended that the students are given the opportunity to rediscover (to reinvent) the ideas and concepts of mathematics with adult guidance through the exploration of a variety of situations and problems of the real world (real world). According to De Lange (1996), the process of developing mathematical concepts and ideas which starts from real world called / mathematical concepts, it can be seen in Figure 1

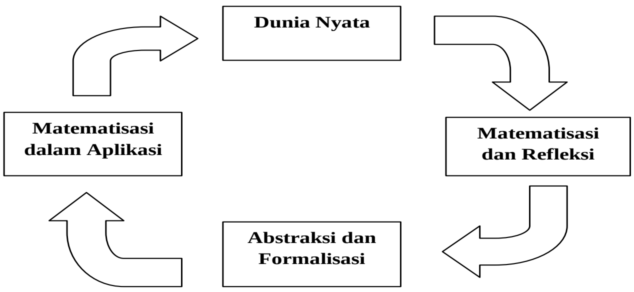

Figure 1. mathematical concepts

Mathematical scheme above represent that the mathematical learning starting from the outer world (real world) and this part becomes important as part of the early mathematical learning. This principle is confirmed Brenner and Moschkovic (2002) which states that teachers must associate daily occurrenceoutside the classroom with math in the classroom. In other words, De Lange (1996) asserted that the process of developing a mathematical concept started from the outer world (real world) and ended by reflecting the obtained solution to the outside world again. So, what do in mathematics education is the use of the outer world inthe first time, mathematical, and back to the the outer world again. All this process is called mathematical conceptual (conceptual mathematization). This means that mathematical learning should be initiated from the outer world and followed their formulation into the world of mathematics and then interpreted again in the outer world.

According to Gravemeijer (1994) there are three main principles in PMR, which is: a) guided reinvention and progressive mathematizing, b) didactical phenomenology, and c) self-developed models

Based on the characteristics of mathematical learning, the application of the PMR approach in the school can be done with the following steps:

1. Before a learning material is given to students, it will be given the planned activities, for example through the singing, the props, a mini workshops, games, or 1-2 a question of contextual / realistic directing so that learners can find or construct their own knowledge.
2. Teachers observed / assessed / examined results of the work learners. Teachers need to respect the diversity of the answers to the learners. This means that every answer of the learner should teachers give good feedback and appreciation.
3. Teachers might ask one or more of the learner to demonstrate his findings on how to solve in the class.
4. Through the teacher questioning may repeatthe answersof learners, in order that other students who have a clear idea about the mindset of learners who have solved the problems.
5. Teacher explained the materials support the question that are being discussed, or the activity which is being done include the information about the correct way to solve the question

An instructional model that is similar to the model of PMR learning approach is Contextual Teaching and Learning (CTL). CTL learning model is a process of learning that emphasizes full of the involvement of students, to be able to find the material studied and relate them to real life situations that encourage students to be able to apply it in their live.

The conceptual framework approach based learning in high school PMR drafted after review (behind cover) about the theory and concepts related to with the study material. Based on the theoretical model development Plomp (2010), the literature review is an activity both at the stage of preliminary research (preliminary research). Review back (review) literature on theories and concepts that have been conducted, showing that it takes some of the theories and concepts to reconstruct the learning model based on the PMR approach SMA. Theory, concepts and materials are summarized and shown in Table 1.

Table1. Summary from Review of Theoretical Development Model PMR-based learning approach in high school

No	Development Stage	Activity	Activities Performed on Research
1	*Preliminary Research*	*Needs and context analysis*	Analyze of Teachers' Charateristics
			Analyze of Students' Charateristics
			Analyze the aim of marhemathic's lesson
		Review of literature	Analyze the theory and concept about RME
		Development of conceptual and theoretical framework for the study	Designing a conceptual framework for the study of development
2	Prototipe *(prototyping Stage)*	*Design prototype*	Designing a model of learning mathematics by PMR approach
		Formative evaluation	Doing validity's test by expert and practitioner about prototype
		Revision	Revising the prototype based on the results *formative evaluation*
3	Penilaian *(Assesment Stage)*	*Summative evaluation*	Doing the practicalities's test and effectiveness of the prototype
4	Dokumentasi secara sistematis *(systematic reflection and documentation)*	*Documentation*	Aranging and refinement prototype
		Reflection	Designing new theories and concepts based on research results

Source: Plomp (2013) which is adapted to the needs of research.

Based on Table. 1 are found that there are 5 (five aspects) that will reconstruct the formation of PMR-based learning model approach in SMA, that is:

1. The construction of models; consists of syntax, reaction principle, the social system, the support system and the instructional impact and impact accompanist. (Joyce and Weil, 1992).
2. The model development; stages of development consists of a preliminary investigation, the prototype stage, the assessment stage and systematic of reflection and documentation (Plomp, 2010).
3. Realistic approach, the approach to the exploration, elaboration and confirmation
4. PMR-based learning approach in high school: learning phase, skill, recitation, discussion, a question answer and presentation
5. Learning materials; High school math, high school math curriculum in 2006

Based on these explanations, compiled and written the framework and the conceptual (frame work and conceptual) approach based on learning model PMR. In High School, and a conceptual framework (frame work and conceptual) is shown in Figure 3. Based on Figure 3, the learning model has five components that have to be met. Five components namely syntax, reaction principle, the social system, the support system, and companion the instructional impact. The fifth component of the model is built (constructed) by several aspects in it.

This research includes development research (research and development), which is conducting research on the development of a product that is oriented to the development of a product which is described and evaluated. According to Borg & Gall (1983) research and development is a process that is used for development, there are stages that must be undertaken by a researcher, which consists of a review of the findings of research products that will is developed, the development of products based on these findings, test field, and make revisions to the revisions to the field test. The product is a learning model-based development approach in high school PMR valid, practical, and effective. Therefore, the discussion focused on three issues, namely the model-based development methods PMR approach, development of a method learning tools, and development of research methods instruments are carried out simultaneously. In other words, during the development of the model, developed in accordance with the learning device models and the development of instruments as well as learning devices.

Based on the procedure development Plomp (2010) are adapted to the needs of research, the form of the activities carried out after adapted to the needs of research can be seen in Table 2.

Table 2. Development Phase Mathematics Learning Model PMR-based approach

Theory and Materials		Writers
Construction Model	Syntax	Joyce and Weil (1992)
	principle reaction	
	Social system	
	Support system	
	Impact Instructional and Companion	
Development Model	*Preliminry Investigation*	Plomp (2010)
	Prototype Stage	
	Assesment Stage	
	Sistematic of Reflection and Documentation	
PMR Approach	Exploration	Freudhental (1992)
	Elaboration	
	Confirmation	
Learning Procces based on PMR aproach at SMA	learning phase	Gravemeijer, 1994
	Skills	
	Recitation	
	Preentation and discussioni	
	Group discussion	
	Question and answer	
Learning Materials	Mathematics of SMA	Mathematics of SMA curriculum in 2006

Source: Plomp (2013) which is adapted to the needs of research.

The data in this study is in the form of quantitative data and qualitative. Quantitative data is the basic data collected through the questionnaire using a Likert scale, and math test results of students. Qualitative data is in the form of comments, feedback, and suggestions in writing by the validator and the result of observations relating to the implementation of the model-based approach to learning mathematics PMR.

Data collection instruments that will be used in this research is the test and non-test. Tests in the form of assessment of learning outcomes math students (to assess how much influence product models mathematics learning-based approach to PMR on student learning outcomes), while the non-test, a questionnaire (questionnaire) is a list of statements given to the students associated with attitudes, interests and opinions students associated with the product model of mathematics learning-based approach to PMR, interview (the data collection instruments, which can dig deeper into related data directly from students, teachers, peers, practitioners, and experts associated with the product model of mathematics learning-based approach to PM) observation sheet sheets observations made by the observer (to determine the level of practicality, and effectiveness of the product of mathematical learning model based approach to PMR) and validation sheets (sheets are made to determine the validity of the mathematical product of the learning model based approach PMR)

Data obtained from various instruments, will be analyzed descriptively qualitative and quantitative, so that it can be seen validity, practicalities, and the effectiveness of the model-based approach to learning mathematics PMR.

RESULT AND DISCUSSION

In this research is conducted from 2015 and been only the completion of the study Introduction (Preliminary Research) where researchers conducted 1) needs and context analysis (analyzing the characteristics of the teacher, student characteristics, and analyze objectives mathematic subject, 2) Review of the literature (analyzing theories and concepts related to PMR), and 3) Development of conceptual and theoretical framework for the study. And still ongoing stages of Prototype (prototyping stage): 1) design the prototype (designed the model of mathematics learning-based approach to PMR, 2) Formative Evaluation (to test the validity to experts and practitioners of the prototype, 3) Revision (revise the prototype based on the results of formative evaluation

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Carefully to analyze the data type of ordinal scale, why?

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Abstract

The study was motivated by the findings in the research that there are mathematical operation type of ordinal scale, in addition to mistake in processing the data type of ordinal scale. Data on the scoring rubric should guarantee the kind of scale that is used, if the data is ordinal it does not apply mathematical operations. As if the data used interval, it must be shown to have the same distance from the level, and apply mathematical operations. Has not found that using a scoring rubric ordinal scale data types and with good reason. Many who defines the type of scales in scoring rubric is ordinal, and apply mathematical operations to him. That is a mistake. Each type of data has its own characteristics, so it is clearly different. Besides treatment for representing and analyzing data there are also provisions. How to analyze the data type of ordinal scale, interval certainly different. Type of ordinal scale can not be converted into an interval scale, if the ordinal scale can be transformed into an interval scale, it may also be converted nominal scale into interval, nominal scale into ratio. It violates the rules, then later why are there parametric test and nonparametric test? The argument is strong enough to say that this type of ordinal scale can not be converted into interval scale.

Keyword: *Ordinal Scale*

INTRODUCTION

From the observation of some of the research thesis/ theses on department of mathematics education found that there are many errors on data processing test instruments and non tests. As in the case below,

GUIDELINES FOR OBSERVATION

Subject : ………………… Data : ……………………
Class : ………………… Observer : ……………………

Give appropriate assessment context by providing a tick mark (√) in column 5 when very good , in column 4 when good, in column 3 when fairly good, in column 2 when bad, in column 1 when very bad !

No	Student Activity	1	2	3	4	5
1	Pay attention to the teacher's explanations					
2	Reading books					
3	Read instructions of student worksheet					
4	Do student worksheet					
5	Work in small groups					
6	Discuss or ask between students and teachers					
7	Actively communicates ideas for learning					
8	Invented the concept itself					
9	Doing exercises					
10	Delivering a mathematical concept with the student's own language					
11	Students are finding a variety of ways or a variety of answers in problem solving					
12	Presenting the results of discussions					

Sources: Yudhanegara (2010)

Figure 1: Observation Guidelines

Observation sheet in Figure 1 uses numbers/scores as category of option to answer each indicator, 5 = very good, 4 = good, 3 = fairly good, 2 = bad, 1 = very bad. The scale used is the ordinal scale.

Data from observation of student activity during learning in the study, could be seen in the recapitulation observernya in the Table is below.

Table of Assessment Activities Students in Observations

No	Student Activity	Assesment			
		I	II	III	IV
1	Pay attention to the teacher's explanations	4	4	4	4
2	Reading books	3	4	4	4
3	Read instructions of student worksheet	4	4	4	4
4	Do student worksheet	4	4	4	4
5	Work in small groups	4	4	4	4
6	Discuss or ask between students and teachers	3	3	4	4
7	Actively communicates ideas for learning	3	3	3	3
8	Invented the concept itself	3	4	4	4
9	Doing exercises	3	3	3	4
10	Delivering a mathematical concept with the student's own language	3	3	3	3
11	Students are finding a variety of ways or a variety of answers in problem solving	3	3	3	3
12	Presenting the results of discussions	3	3	3	3
	Average	3,3	3,5	3,5	3,6

Conclusion:
Based on the assessment of four observer to the activity of students in learning, between students and teachers, and students with a student, although activity appears interactions are considered less than optimal. In the table above shows the average value of the above enough, this implies that the assessment of the involvement and active students during the learning takes place.

Sources: Yudhanegara (2010)

Figure 2: Making Conclusion

Figure 2 is the result obtained from the observation sheet in Figure 1 taken from 4 person observer. To describe each assessment observer is using the average of the numbers/ score category option.

Table of Scoring Rubric

Scor	Assesment of Ability of Visual Representation
0	There is no answer or if there is a wrong representation made answers.
1	Answer incomplete (only a few questions were answered), less precise.
2	Answer incomplete (only half of the questions were answered), only partially right.
3	Answer nearly complete (most questions answered correctly).
4	Detailed answers (all questions can be answered correctly .

Sources: Yudhanegara (2010)

Figure 3: Scoring Rubric

To measure the ability of a mathematical representation of the research done is to use a scoring rubric in Figure 3. Category assessment using the numeric/ scores namely 0 = No answer or if any representation made wrong answer, 1 = answer is incomplete (only a few questions answered), less precise, 2 = Answers incomplete (only half of the questions were answered), only partially right, 3 = Answers nearly complete (most questions answered correctly), 4 = complete answer (all questions can be answered correctly. Scale which is used in the scoring rubric is ordinal.

Table of Results of Test Instruments

No	Student	Scoring of test items									Total Scor
		1	2	3	4	5	6	7	8	9	
1	S 1	2	4	2	2	2	0	0	2	0	14
2	S 2	1	4	4	2	2	2	0	2	2	19
3	S 3	0	4	4	0	2	2	0	4	3	19
4	S 4	2	3	1	2	2	2	0	2	2	16
5	S 5	1	4	4	2	2	2	0	4	4	23
6	S 6	1	4	4	0	2	2	0	4	4	21
7	S 7	2	3	1	2	2	2	0	4	2	18
8	S 8	2	4	1	2	2	2	0	4	0	17
9	S 9	1	2	1	3	2	0	0	4	0	13
10	S 10	0	1	3	4	3	3	0	4	4	20
11	S 11	3	4	4	2	2	0	0	4	0	19
12	S 12	3	4	4	2	2	1	0	2	0	18
13	S 13	3	4	3	1	2	2	0	4	1	20
14	S 14	3	4	4	2	2	0	0	4	0	19
15	S 15	4	4	4	4	1	0	0	0	0	17

As for the search for a validity coefficient is to use a product-moment correlation formula put rough numbers (raw score), as follows:

$$r_{XY} = \frac{N\sum XY - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left(N\sum X^2 - \left(\sum X\right)^2\right)\left(N\sum Y^2 - \left(\sum Y\right)^2\right)}}$$

Note:
X is test items and Y is total scor

Sources: Yudhanegara (2010)

Figure 4: Correlation Formula Determination

Figure 4 is the result of the test instrument based on a scoring rubric in Figure 3. In Figure 4 the author intends to seek the validity of the instrument by using the formula Pearson product-moment.

From the above case the author does not mention explicitly what kind of scale that is used on the observation sheet to measure the activity of the students and the scoring rubric to measure the ability of mathematical understanding. If studied further that the scale of the observation sheet and scoring rubric above have ordinal scale types. In the observation sheet processing, why apply mathematical operations on ordinal scale? Then we look at the scale on the scoring rubric instrument mathematical understanding, the authors did not prove that the scale interval. So that the scale should ordinal scale, then to test the validity of the instrument must be using Spearman's rank correlation formula by first rank of each score. For this case, why the product-moment correlation Person used?

DISCUSSION

Measurement

Measurement is the most important initial activity in the statistical analysis. Measurement of the variables is defined as an attribute or a variation determination value, or the extent size of the variables to be measured. Attributes or variations of the value of a variable obtained through observation of the subjects or units of study based on indicators of these units. Measurement results provide data which will be processed by a particular statistical analysis techniques.

Measurement scale

Nominal scale

Nominal scale is the classification, categorization, identification of events or phenomena into classes or categories so that entry into one class or category is the same in terms of attributes or properties. Class or category is just a name to distinguish an event or occurrence of events with other events. Differences figures only indicate the presence of an object or subject of a separate and unequal. Nominal scale will produce discrete data. Mathematical operations can apply to this type of scale thus does not exist, because the qualitative data. Differences that exist on this scale qualitative nature. There is no attempt to look at quantitative measures of the research object. Eg 1 = sex male, 2 = female gender. The figures are not meaningful quantitative but merely grouping or categorization.

Ordinal scale

An ordinal scale of measurement results referred to at the level of ordinal numbers when the function shows the hierarchy or rank. Differences figures possessed an object from another is not showed quantitative differences, but the differences only qualitative level. When there is a level 1, 2, 3 then we can not say that the distance is equal to a 2-1 3-2, but only applies that 3> 2, or 2> 1, or 3> 1. The distance between the two levels of sequential numbers do not always same. For example: Award winning numbers in the championship boxing, the sequence of house numbers, we know the numbers 24 and 126 is for example in the same direction of the number 10, and many house between number 24 and number 126 more than the number 10 to number 24, but not necessarily the distance from number 24 to number 126 farther than the distance from number 10 to number 24. Another example is the point scale on a scale of attitudes, namely 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and strongly disagree = 1. ordinal scale can not be subjected to the calculation of the mathematical operation. Statistics that apply on this scale is called order statistics.

Interval scale

Results measuring interval scale is ordinal measurement results that have a fixed distance between levels (always the same). So in a series of numbers 2, 3, 4, 5, 6, 7 then we can say that within 5-3 equals 7-5 or 6 - 4. This scale does not have an absolute zero price so if the room temperature of 0 ° Celsius of results measurement of the size of the thermometer does not mean that at all has a temperature of 0 ° if we use the Fahrenheit scale. Differences in figures at the level of the interval already have quantitative and qualitative differences. Data at the interval level already has a quantitative and qualitative difference. Data at the interval level subject to the operations of addition (+) and subtraction (-). For example: the numbers on the thermometer temperature, work climate, performance, GPA. When the ordinal scale applicable statistics are statistics sequence, then the scale interval also applies correlation and regression.

Ratio scale

Level ratio is basically the interval level that has an absolute zero price, meaning the price of zero on this scale is indeed showed that the attributes measured did not exist at the object in question. So the measurement results showed zero means the object being measured really does not have the characteristics in question. For example, the zero point on the bar, meaning objects has no length, or zero point on the measurement of weight, area, volume, speed, is an example of the data with the level ratio.

For the purposes of the study, researchers can change the scale of higher level to a lower level scale, for example change the scale ratio of the scale interval, the scale interval the ordinal scale, and the scale ordinal to nominal scale. Even on the scale ratio/ interval to nominal scale, for example, score statistics exam results of students in the range of scores (0-100) can be converted into two categories, namely pass (1) if the student gets ≥ 70 and does not pass (0) if it gets a score of < 70. It is on the contrary, always can not be changed from the low level scale to scale higher level. For example nominal scale to ordinal scale/ interval. The difference between the scale seen in the following table.

Difference Measurement Scale

Table 1: Difference of Measurement Scale

scale	classification	Order	Same distance	Absolute zero
Nominal	√			
Ordinal	√	√		
Interval	√	√	√	
Ratio	√	√	√	√

Selection of Engineering Statistics

Correct understanding of the scale of measurement will help researchers choose the right type of statistics to analyze the research data have been obtained. Selection of techniques descriptive and inferential statistical analysis in the study are based on a scale of measurement results nominal, ordinal, interval and ratio.

Table 2: Descriptive Statistics Analysis Techniques

Measurement scale	Statistical Techniques to Use
Nominal	Mode, frequency tables, percentages, and Graphs
Ordinal	Minimum, Maximum, Median, Table Frequency, Percentage, and Graphs
Interval	Mean, Minimum, Maximum, Range, Variance, Standard Deviation, Coefficient of Variance, Tilt, Sharpness, and Graphs
Ratio	Mean, Minimum, Maximum, Range, Variance, Standard Deviation, Coefficient of Variance, Tilt, Sharpness, and Graphs

Table 3: Technical Analysis Inferential Statistics

Scale	Associative and Comparative Research			
	Associative	Descriptive (1variable)	Comparative (2 samples)	Comparative (>2 samples)

			Dependent	Independent	Dependent	Independent
Nominal	Soumer's d (ddy), Koef Kontingensi C, Gamma, Tau a, b, c	Binomial, x^2 for -1 sample	Mc Nemar	Fisher Exact, x^2 for – 2 Samples	X^2 for-k Samples, Cochran Q	X^2 for – k Samples
Ordinal	Correlation rank Spearman, Kendall, Konkordansi	run test	Sign test, Wilcoxon test	Median test, Mann-Whitney test Kolmogorof Smirnof	Freadman, Anova 2 way	Median test, Kruskal Wallis Anova -1 way
Interval	Product Moment Pearson, Partial Correlation, Regression	t-test z-test	t-test (correlatio n)	t-test z-test	F-test with Anova -1 Jalur, Anova ≥2 jalur	F-test with Anova-1 way, Anova ≥2 way
Ratio	Product Moment Pearson, Partial Correlation, Regression	t-test z-test	t-test (correlatio n)	t-test z-test	F-test with Anova -1 way, Anova ≥2 way	Uji-F with Anova-1 way, Anova ≥2 way

THE ANSWER OF PROBLEM

Does 1, 2, 3, 4, 5 on questionnaires apply mathematical operations? Figure 1, 2, 3, 4, 5 observation sheet is not a number. The figure was only able to classify and sort it, so the scale is a type of ordinal scale, it does not apply mathematical operations. The statistical techniques that can be used can be seen in Table 2 and Table 3.

What type of data included in the scoring rubric? Data on the scoring rubric should guarantee the kind of scale that is used, if the data is ordinal it does not apply mathematical operations. As if the data used interval, it must be shown to have the same distance from the level, and apply mathematical operations. Has not found a good reason that rubric types of data on the scoring rubric is the interval. Many who defines the type of scales in scoring rubric is ordinal, and apply mathematical operations to him. That is a mistake.

What kind of data can be converted into ordinal scale interval? Each type of data has its own characteristics, so it is clearly different. Besides treatment for representing, analyzing data there are also provisions. How to cultivate the types of data ordinal scale, interval certainly different. Type ordinal scale can not be converted into an interval scale, because each of data have different characteristics. If ordinal scale can be transformed into an interval scale then applies also converted into a nominal scale interval ratio even to scale. It violates the rules, then later why no parametric test and nonparametric test? The argument is strong enough to say that this type ordinal scale can not be converted into an interval scale.

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Methodology in Undergraduate Mathematics Education Research Culture: The Common Mistakes in Experimental Design

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Abstract

Over the past several years, most of the college students has been using quantitative methods in undergraduate mathematics education research. Quantitative methods remain a necessary condition, albeit not a sufficient condition in all cases, for handling many complex problems faced by mathematics education researchers. The purpose of this article is to examine how quantitative methods are used generally in undergraduate mathematics education research. The fact, most of quantitative researchers used the experimental design in their research. The common mistakes in experimental design: (a) lack of a randomized controlled trial, (b) lack of double-blind studies, (c) failure to perform sample size analysis before the study begins, (d) failure to choose the technique of sampling, (e) rubric grading errors, and (f) failure to perform data analysis. These weaknesses can result a culture of mathematics education research in undergraduate programs is not qualifying for testing or building a theory. Experimental design defined as the overall plan for collecting data in order to answer the research question, also the specific data analysis techniques or methods that the researcher intends to use in experimental research.

Keyword: *quantitative methods; experimental design; mathematics education research; undergraduate programs*

Mathematics Education Research Culture in Undergraduate Programs

Research in mathematics education has two main purpose: to understand the nature of mathematical thinking, teaching, and learning, and to use such understandings to improve mathematics instruction (Schoenfeld, 2000). Some researcher have recently argued that the field should focus on research methodology in general, including quantitative, qualitative, and mixed methods (Tashakkori & Creswell, 2008; Johnson & Onwuegbuzie, 2004).

Over the past several years, research in mathematics education (in undergraduate programs in Indonesia, at least), was dominated by the implementation of teaching and learning models to improve mathematical thinking. Most of undergraduate students has been using quantitative methods in mathematics education research.

Quantitative methods remain a necessary condition, albeit not a sufficient condition in all cases, for handling many complex problems faced by mathematics education researchers. The fact, most of quantitative researchers used the experimental design in their research. It has established culture of mathematics education research in undergraduate programs.

The Common Mistakes in Experimental Design

There are six common mistakes that novice researchers often make when using experimental design. These mistakes are usually made during preparation, collection, and analysis data.

1. Lack of a randomized controlled trial

The most reliable experiment to evaluate a treatment effect is a randomized controlled trial, in which a population is randomly divided into a test group, which receives the treatment, and a control group, which does not. However randomization often can not be done in circumstances such as the following: research area is very widespread as in Indonesia, especially when communication between the members of the population is difficult to known (Ruseffendi, 2005).

Randomization techniques aimed to create group which almost the same characteristics in the study. In quantitative research, the sampling technique often used is cluster random sampling or random sampling area. Although the technique randomness of the sample is not good, but this technique is often more likely to be implemented when compared to simple random sampling technique. Thus, the sampling technique seems to have become a culture in the mathematics education research.

Control in research is essential for a fair comparison. But in some cases, there are situations where we can't use a randomized controlled trial. We can't ethically test the effects of cigarettes for mathematical thinking by requiring a control group to smoke. In such situations, we make do with non-randomized studies, and there are various statistical techniques for dealing with the situation. But if we see a published study that could have used a randomized controlled trial and didn't, that's a warning sign that something may be wrong.

2. Lack of double-blind studies

Double-blind study is an experimental procedure in which neither the subjects of the experiment nor the persons administering the experiment know the critical aspects of the experiment. Therefore, the researcher nor the respondent does not know the status of the respondent if included in the intervention or non-intervention. The strength of this design can minimize confounding factors that can lead to bias in the results.

Experimenter bias occurs when a researcher unwittingly influences results by either administering the experiment or collecting and analyzing the data in a biased fashion. This can happen when the experimenter has a personal stake in the results of the experiment or when the nature of the experiment is particularly subjective, such as in psychology and other social sciences. In mathematics research education, double-blind study required to avoid participant bias, so that their knowledge can't influence by their behavior.

Implementation of interventions with double-blind study in educational research is often hindered by ethical issues. Ethically, this intervention should be made the subject of research that can be justified. Whereas, if an intervention is known by research subjects then there is a tendency from research subject so the research process does not naturally.

3. Failure to perform sample size analysis before the study begins

The larger the sample size necessary to assess whether an observed effect of treatment. On the other hand, the more effective or harmful the treatment, the smaller the sample size required to detect that benefit or harm (Wittes, 2002). Therefore, it is important to know how many subjects are needed. It is necessary to use a technique for determining the sample size in the research.

In fact, many researcher in undergraduate programs was failed to perform sample size analysis before the study begins. They have too few subjects when doing research. To avoid this mistake, prior to created an efficient method of determining the sample size needed to be representative of a given population.

The National Education Association has published a formula for determining sample size. Regrettably a table has not bee available for ready, easy reference which could have been constructed using the following formula (Krejcie & Morgan, 1960);

$$s = \chi^2 N(1-P): d^2(N-1) + \chi^2 P(1-P)$$

$s =$ required sample size
$\chi^2 =$ the table value of chi square
$N =$ the population size
$P =$ the population proportion (assumed to be 0.50 since this would provide the maximum sample size)
$d =$ the degree of accuracy expressed as proportion (0.05)

4. Failure to choose the technique of sampling

Sampling in educational research is generally conducted in order to permit the detailed study of part, rather than the whole, of a population. The information derived from the resulting sample is customarily employed to develop useful generalizations about the population. These generalizations may be in the form of estimates of one or more characteristics associated with the population, or they may be concerned with estimates of the strength of relationships between characteristics within the population (Roos, 2005).

In generally, there are two technique that can used to determine the sample; probability sampling and nonprobability sampling. But some researchers have some problem in identify potential sampling techniques that might effectively achieve the research goals. In undergraduate mathematics education programs, almost all of researchers choose the cluster/area random sampling and purposive sampling, which does not produce the equivalent group .

5. Rubric grading errors

A rubric is a great tool for teachers, because it is a simple way to set up a grading criteria for assignments. Not only is this tool useful for teachers, it is helpful for student as well. There are three common rubric grading errors in undergraduate mathematics education research:

a. Failure to list the criteria that will be used in assessing performance.
b. Failure to determine a performance level and write a description for each performance level
c. Failure to evaluate and revise rubric as needed.

6. Failure to perform data analysis

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. Some researchers in undergraduate mathematics education have to failed in perform their data analysis. In general, there are three types of mistakes in performing data analysis:

a. Reporting to many piece information (e.g. calculating the means and standard deviation for every variable which not of a main in the study, reporting too many decimals in the case of test value…)
b. Incorrectly performing statistical procedures which are not suitable for a particular set of data (e.g. calculating Person's product-moment correlation coefficient for data given on the ordinal scale, instead of using Spearman's rho coefficient correlation)
c. Failed to present the result of their study (e.g. using bar plots to present arithmetic means graphically)

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THE DEVELOPMENT OF *HYPOTHETICAL LEARNING TRAJECTORY* (HLT) FOR TEACHING CIRCLE WITH REALISTIC MATHEMATICS APPROACH

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Abstract

One effort to improve the quality of learning is a improvement of learning process that can be helped students uunderstand the concept, principle, and the mathematical operations. Mathematics involve many formulas need constituted with concept comprehension. Many students are not being able to interpret the symbols which are used in a formula due to they did not construct the formula and the concept behind as well. It should be designed the learning route to enable students to learn mathematics, including circle materials. The research objective is to develop Hypothetical Learning Trajectory (HLT) with realistic mathematics approach that can be helped students understand concept relates with circles, as well as finding the formula of circumference and area of circles. The results of this study describes development of HLT happens for 3 cycles, i.e cycle 1 (pilot experiment), cycle 2 (teaching experiment 1), and Cycle 3 (teaching experiment 2). Activities for cycle 1 and 2 held on SDN 1 Banda Aceh, while the activities on cycle 3 on MIN Rukoh Banda Aceh. Data collected through students' written works, field notes, audio, and video of the learning process. Research shows some revisions of HLT based on suggestions from observers and teachers. The HLT can help students find the formula of circumference and area of circles, so it can be recommended to review the next researcher.

Keywords: Hypothetical Learning Trajectory (HLT), realistic mathematics approach, circumference and area of circle

INTRODUCTION

Geometry is a part of mathematics that studies the shape , their relationships, and their properties (Bassarear, 2002, p. 463). Spatial visualization capabilities, constructing and manipulating mentally of two or three-dimensional object is one aspect of thinking geometry (NCTM, 2000: 41). But in reality, many studies reveal that the geometry is difficult to be taught and learned (Luneta, 2015). Many students encountered misconceptions about geometry (Özerem, 2012). Children fail to produce a plan of area as a whole and to describe their journeys due to they do not link all landmarks in a single network (Piaget, Inhelder, &Szeminska(1960). Students' difficulties in learning geometry with regard to the basic concepts of geometry, such as high difficulty understanding the triangles, angles, conservation area, and the relationship between perimeter and area (Gal and Linchevski, 2010).

Circumference and area of circle are taught at grade 5thof primary school in Indonesia. Students learn some new terminologies such as diameter, radius, chord, and pi. Students also learn the formula of circumference and area of circle (Kemendikbud, 2013). Those formulas are difficult for students due to they contain algebraic expression.

Indonesian government has published student textbook to help students learn circle for grade 5that primary school (Karitas et al., 2014). Nevertheless, we found some jumps of learning activities at that textbook. For instance, the first lesson, students ask to use compass to draw circle, then teacher inform a new concept namely radius and diameter regarded to the drawing of circle. Then, at the same lesson, teacher asks students to measure the circumference and diameter of circle using any yarn then they divided the circumference of circle by its diameter. These activities did not engage students to explore some new concepts by themselves such as the meaning of diameter, how to find the central of circle, and the relationship between diameter and radius.

According to constructivism, students themselves construct their knowledge. Teacher must focus on meaning and understanding in mathematics (Petersen, 1988). Hans Freudenthal as founding father of *Realistic Mathematics Education* (RME) stated that mathematics as a human activity. Students engaged in activity of solving problems, looking for problems, and organizing a subject matter (Gravemeijer, 1994). In line with van den Heuvel-Panhuizen (1996) stated that teacher in teaching mathematics should involve students in the process of invention.

This study develops the *Hypothetical Learning Trajectory* (HLT) for teaching circle at primary school refers to *Realistic Mathematics Education* (RME). The research question is 'what is the different activities among *Hypothetical Learning Trajectories* (HLTs) to support students learn circumference and area of circle?'

THEORETICAL FRAMEWORK

Teaching Geometry at Primary School

Usiskin (1982) explain a few things about the geometry, there are: 1) geometry is a branch of mathematics that studies the visual patterns, 2) geometry is a branch of mathematics that connects mathematics to the real world, 3) geometry is a way of presenting the phenomenon that is not visible or physical, 4) geometry is a example of mathematical system. Furthermore, van de Walle (1990) reveals five reasons why geometry is very important to learn. First, geometry helps people have a full appreciation of his world, the geometry can be found in the solar system, geological formations, crystals, herbs and plants, the animals come to the works of art architecture and the work of the machine. Second, exploration geometry can help develop problem solving skills. Third, geometry plays a major role in other areas of mathematics. Fourth, the geometry used by many people in their daily lives. Fifth, the geometry is challenging and interesting. Basically geometry have a greater opportunity to understand the students compared with other branches of mathematics. This is because the ideas of geometry already known by students since before they enter school, for example, line, area and space.

Based on description above, the geometry need to be introduced to the students early on. Especially for elementary school students, the introduction of geometry should be supported with concrete objects and everyday experiences of students. According to Piaget's theory of intellectual development, students at primary school are in the concrete operational period. How students think about geometry, is still based on concrete objects and real situations. Primary students in lower grade learning geometry by informal; feeling and guessing. Students at higher grade, have the ability to reason is more abstract, but still depends on a concrete presentation of the studied geometry topics. This period is characterized by the logic thinking skills, to organize their mind so that synchronously, looking at the structure of the total, and arrange all of them in hierarchical relationships.

Based on the Indonesian curriculum, learning geometry especially on learning circle has been taught since elementary school students sitting in. Students already studying the properties of shape including the properties of circle. In third grade, students have studied the properties of the plane one of them is a circle. In the fifth grade, students also learn about the circumference and area of a circle. More in-depth and detailed discussion on finding a formula circumference and area of a circle of students studied in fifth grade (BSNP, 2006;

Kemendikbud, 2013). The Core Competence and Basic Competence for geometry in fifth grade that is a reference in this research Core Competence: Understanding the factual and conceptual knowledge by observing and trying [to hear, see, read] and asked by curiosity critically about himself, God's creatures and activities, and objects that met in homes, schools, and playgrounds. while the Basic Competence isfinding the formula circumference and area of a circle through an experiments.

Realistic Mathematics Education

In Realistic Mathematics Education (RME), Freudenthal (1983) stated that "mathematics is a human activity" therefore suggested mathematical departed from human activities. Learning mathematics is the process where mathematics invented and construct by human, so in mathematics learning should be constructed by students than by teachers. According to the Realistic Mathematics, the variasion of contextual problem be integrated into the curriculum from the beginning. Freudenthal find guided reinvention as a process undertaken students actively to rediscover a mathematical concept with teacher guidance. So, in this case a student-centered learning and teachers as facilitators.

According to Freudenthal in Gravemeijer (1994), there are three principles of RME namely (i) guided reinvention and progresisive mathematizing, (ii) didactical phenomenology, (iii) self-developed models. Based on the principle of guided reinvention, students in learning math should be given the opportunity to experience the process experienced by the experts. These efforts will be achieved if the learning is done using the situation in the form of phenomena that contain mathematical concepts and real to the students' daily lives. Refers to the didactical phenomenology principle,the mathematical concepts is an analysis done on mathematical concepts and linked with other interesting phenomena. The challenge in this principle is found the phenomenon that can be linked to mathematical concepts.

The role of self-developed models is a bridge for students from the real situation to the concrete situation or from the informal to the formal mathematics. This means that students develop a model of informal situations leading to the formal stage.

From the three principles RME above, operationalized more clearly in the five characteristics according to de Lange (1987) with regard to the learning model in this case related to the material (characteristic 1, 2 and 5), the method (characteristic 4) and assessment (characteristic 3): (i) Using the context, (ii) The use of mathematical models of progressive, (iii) the utilization of the results of students' construction, (iv) interactivity, (v) intertwinne.

In designing learning activities in the classroom for a specific topic, the teacher must have a conjecture or hypothesis and is able to consider the students' reactions to each stage of learning trajectory toward the learning objectives are implemented. Freudenthal in Gravemeijer & Eerde (2009) explains that students are given the opportunity to build and develop their ideas and thoughts when constructing mathematical. Teachers can choose the appropriate learning activity as a basis to stimulate students to think and act when constructing the mathematical concept.

In the process of those activities the teacher should anticipate any mental activity that emerges from students with regard to the learning objectives. Predicting and anticipating are called Hypothetical Learning Trajectory (HLT) (Simon, 2004). HLT is a hypothesis or prediction of how developing students' thinking and understanding in learning activities. According to Gravemeijer (2004), HLT consists of three components: (a) the purpose of learning mathematics for students, (b) learning activities and devices or media are used in the learning process, (c) a conjecture of learning processes and emerging and developed of students strategies.

According to Bakker (2004) HLT is a the actual relationship between a Instruction Theory and teaching experiment. From this relationship there is a conjecture that can be revised and developed for the next learning based retrospective analysisis after teaching experiment carried out.

METHOD

This study is a design research with three procedure namely, preparation (Preparing for the Experiment), trials on HLT (the teaching experiment), and retrospective analysis (the Retrospective Analysis) (Gravemeijer dan Cobb, 2006). However, in this paper, we will discuss the second step, trials on HLT (the teaching experiment) that was conducted in 3 cycles, cycle 1 (pilot experiment), cycle 2 (teaching experiment 1), and cycle 3 (teaching experiment 2). Each cycle produced HLT, this paper described only two HLT, due to the revision of HLT in cycle 1 and cycle 2 was not significant, HLT that would described is HLT 1 which was produced in cycle 2 (teaching experiment 1) and HLT 2 which was produced in cycles 3 (teaching experiment 2). The activity of cycle 1 and 2 conducted in fifth grade in elementary school. The sample of this study was 5A and 5B. While the third cycle activities conducted at MIN Rukoh Banda Aceh.

Research data collection used field notes, video recording and observation learning sheet. Data were analyzed based on the results of field notes, video recording and observation sheet. The recording of teaching learning process was used for the HLT revising consideration.

RESULTS AND DISCUSSION

In this study, the aim of designing HLT was to help students to understand the concepts related to the circle and find a formula circumference and area of a circle with a realistic mathematical approaches. This table 1 below are presented the differences between the learning objectives and activities of students on HLT 1 and HLT 2.

Meeting	The learning objectives and activities of the students at HLT 1	The learning objectives and activities of students on HLT 2
1	• Students could find out a relationship between center line and the circumference of a circle by watching the video of rapa'i making • Students could find out the value of π through comparing circumference of with a diameter of around rapa'i that had been marked on its center point	• Students could find the center point of circle. The activities is drawing the biggest square in side of circle so that all of angles are on the circumference. The diagonal of square as the centre point of circle • Students could identify the radius and the center line of the circle through the help of objects in daily life such as a bicycle wheel and a fan • Students could find out the value of π by measuring and comparing the circumference by the diameter
	• Students could find out the formula of the circumference of a circle through measuring rapa'i	• Students could find the relationship between the circumference and diameter

2	(rabana) • Students could solve problems related to the circumference of a circle	through measurement • Students could find the formula of circumference of a circle through the measurement activity • Students could freely choose the value of pi for radius of multiples of 7 or not by doing LAS
3	• Students found the formula of area of a circle formula that had a relationships with various forms of the other plane.	• Students found the formula of area of a circle using the formula area of a rectangle and a parallelogram, through the following activities. – Construct a circle segment to be plane of rectangle and parallelogram – Linking formula area of a rectangle or parallelogram to find the area of a circle formula

Based on the table above, the revision of HLT of first meeting was in the context of learning. The context used for HLT 1 was rapa'i (tambourine), which already marked in its center point. This was done because researchers suspected the students' difficulties in determining the center point of a circular object. As a result, students did not construct their own point of the circle center and found no relationship between the radius and diameter of a circle. Therefore, we revised HLT 1 to HLT 2 as follows.

Teachers demonstrated objects that has shape like circles, fans and models of bikes as shown by Figure 1. Students were asked to indicate the center point, radius, and diameter of fan or a bicycle’s wheel.

Figure 1. Teachers demonstrated a picture of a fan and models of bikes

Furthermore, students were given the opportunity to paint the center point of circle, radius, and diameter with its own way. Based on observation of the implementation of the

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HLT 2, the teachers asked the question "who can determine the center point of the circle drawn on the blackboard?". One of the students spontaneously painted the circle's center point on the board by interpreting the biggest square that tangent the circle’s circumference, and then drew the line of two diagonal of the square so the intersecting point is the center of the circle (see Figure 2 and Figure 3).

Figure 2. Students were given the opportunity to find the center point of circle

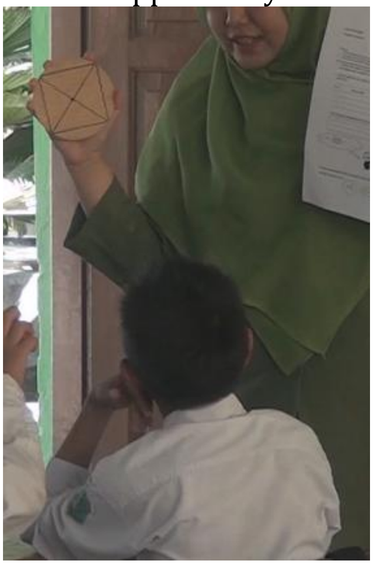


Figure 3. Teacher shows students' work in finfing the center point of circle

Based on the experience, we concluded that student could build their knowledge by the aid of tools that close to the their daily life. Students were also able to find the center point of the circle by themselves, although the teacher did not demonstrated it. It is supported by Freudenthal Grameijer & Eerde (2009). They said that students are given the opportunity to build and develop their ideas and thoughts when constructing mathematics.

The next revision of HLT 1 was on the students activity, comparing the value of circumference of rapa'i with the center line of rapa'i provided in each groups. Not all student in group got a opportunity to find the value of pi and the variation of the value of pi was a little. It impressed them that the value of pi was set by mathematician. Therefore, in the next cycle in the learning HLT 2, each student carried a circular object on the condition that the object could easily measured circumference and it had to be accurate. At the time of the learning process, we found students who managed to find an accurate value of pi is 22/7 or 3.14 (see Figure 4). Based on these activities, we concluded that the varying contexts could help students find the value of pi. It was supported by de Lange (1987) which said that by using the context, students can be involved actively to explore the problem.

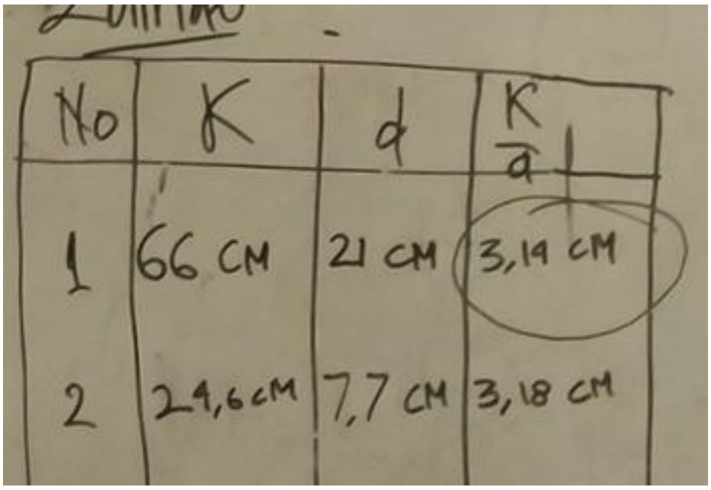


Figure 4. The variation of K/d from students' worksheets

HLT revision of the second meeting was not so significant because of the HLT 1 and HLT 2, students discovered the value of pi by wrapping yarn along the circumference of the circle and comparing them with the diameter of the circle. Students found that the circumference of a circle was 'three times more' than the diameter of a circle and the teacher said that the value of the 'three times' was the value of pi. Furthermore, by teacher’s guidance, students knew that the circumference of a circle is the result of pi times the diameter. However, the HLT 2 added activities chosen to use the value of pi = 22/7 with the value of pi = 3.14 to resolve the problems related to the circumference of a circle (see Figure 5).

Diberikan diameter dan jari-jari lingkaran berikut. Pilihlah nilai π, $\frac{22}{7}$ atau 3,14, agar mudah menghitung keliling lingkaran, lalu isikan ke dalam tabel.

No.	Ukuran yang Diberikan	Nilai π yang Dipilih
1	Panjang diameter 14 cm	
2	Panjang jari-jari 21 cm	
3	Panjang diameter 100 cm	
4	Panjang jari-jari 20 cm	

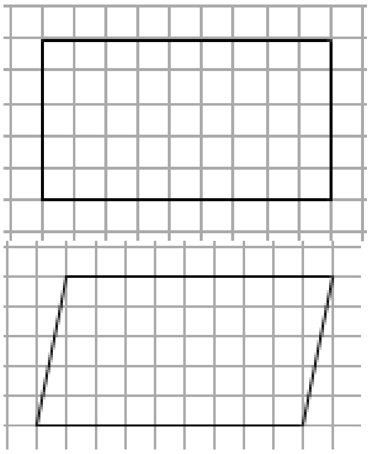
Hitunglah panjang keliling lingkaran yang diberikan pada tabel di atas.

Jawab :

Figure 5. Students choose pi to calculate circumference easily

HLT Revision of third meeting was on the activity of finding the formula area of a circle. Although HLT 1 and HLT 2 has the same the purpose of learning, that is finding a formula area of a circle using a relationship between area of rectangular and parallelogram but the activity that occurs much different. On HLT 1 students are given the opportunity to cut a circle and arrange them to be the other plane to find a formula for the area of the circle. The students spent much time in cutting circle, and the size was not balanced, in addition students are also difficulties in finding a formula because students did not realizethat the area of plane is same even though it was cut and combined. Therefore, the revision in HLT 2 was done. The teacher’s activities was as follows.

a. Students are asked to mention the kinds of plane that had been learned and the formula of area as well.
b. Students are asked to determine the area of a rectangle and a parallelogram using the unit circle as a picture.



c. The teacher asks the students to cut parallelogram and putting it back together to form a rectangle
d. Teachers indicate that the area of parallelogram before and after cutting (then constructes into a rectangle) is the same.

Teachers gave the segments of circle that had been cut to the students, and gave students freedom to put the segment into parallelogram or rectangle. Students wrote the area of circle based on the area of a rectangle (Figure 6) or the area of parallelogram (Figure 7).

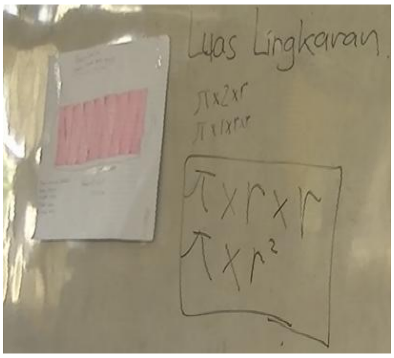


Figure 6. Students arrange some sector of circles into rectangle to find the formula of circle area

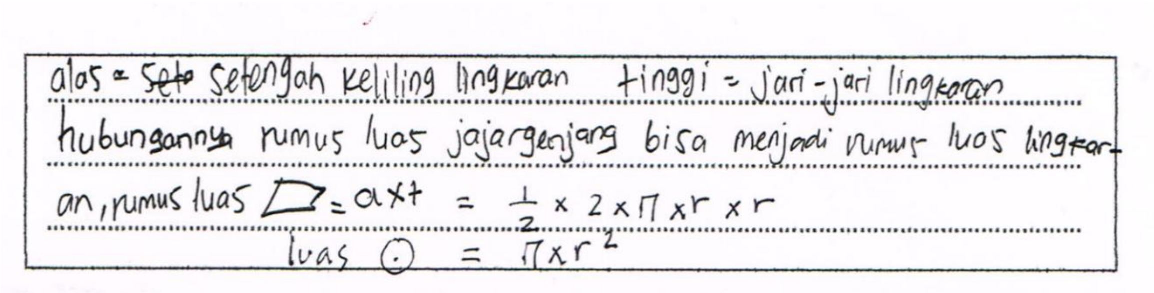


Figure 7. Students find the formula of circle area based on parallelogram area

The application of the concept of conservation could make the student easier to find the area of a circle. This was supported by Funny (2013), he said that students that is understand the concept of conservation is able to build an understanding that recomposition will preserve the area of a plane because no part of the plane is being discarded or left (identity). Students also found that two plane could have the same area even though they had a different shape.

Based on description above, we concluded that improving the quality of learning not only by compiling a learning tool but should make revision of learning tools corresponding inputs of an observer during the learning process that is repeated, so it can produce HLT that can be applied in the learning process. This is supported by the Bakker (2004) that said HLT is a relationship between a learning theory (Instruction Theory) and trials of the real teaching (teaching experiment). From this relationship there is a conjecture that can be revised and developed for the next learning based retrospective analysisis after teaching experiment carried out.

This is accordance with the opinion of Gravemeijer and Cobb (2006), they said that the research design cycle can occur repeatedly, the cycle will stop when the learning objectives have been achieved and the answer to the research question has been obtained and accurate. This study therefore resulted HLT to help students understand the concept of finding a formula circumference and area of a circle. Also expected HLT developed can contribute to the improvement of mathematics education in Indonesia.

CONCLUSION

The teachers' efforts in developing materials of circumference and area of the circle through realistic mathematics approaches can be done with several activities. The aim of each development is always to improve the learning process, in order to help students understand the concept. Lessons are conducted with realistic mathematics education can provide an opportunity for students to develop patterns of thought. Learning to finding formulas circumference and area of a circle is usually only given directly to the student by the teacher, it is actually derived from the phenomena that occur in the real world and can learn how to find it. so that students are able to find the formula circumference and area of a circle and able to understand the meaning of the formula circumference and the real area of a circle.

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LEARNING THE RULE OF ENUMERATION AT MARKETING CLASS XII BY USING BARCODES WITH THE PMRI APPROACH

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Abstract

The objective of this study was to produce a learning trajectory that can help students understand the materials of enumeration rule by using barcodes after they have carried out the industrial work practice in the work place and industry in the course of mathematics with PMRI approach, PMRI is Indonesian Realistic Mathematics Education (IRME). This is Design RisetT types Validation Study, theoretic permutationcan be taught through change-of-place games by using puzzle boards. Permutation and combination are part of the enumeration rule so barcodes are used to substitute for puzzle boards. The researcher thinks that barcodes are suitable media to use in this study as a starting point. This was a research design that would discuss the first cycle of teaching experiment; the subjects of the study were 8 marketing students of class XII with 3 low ability students, 3 moderate-ability students and 2 high ability students. The data were collected through interview, observation, written test, documentations and notes during the activity. The results showed that learning enumeration rule by using barcodes could enchance the students' understanding of the concepts. The percentage of low-ability students from 37.5% to 12.5%, the moderate-ability students from37.5% to 25%, and high ability students from 25% to 62.5%

Keywords:*barcodes, research design, PMRI*

INTRODUCTION

Enumeration is often considered similar to calculation, which is a mathematical action involving addition, subtraction, multiplication occurring at aparticular event. The rule enumeration is a term used in the language of probability, that is the way or the rule for calculating all the possibilities that can occur in an event (Gordon; 2006). Marketing expertise competence is one of the competencies of commerce study program, which requires the students to be able to read market opportunities and to plan product offerings to consumers (Soejandari, Erna : 2013). Mathematics subjects is one of adaptive subjects which support productive, so that adaptive subjects can make the students understand and master the basic concepts and principles of science and technology, especially in the field of bussines and management, to be applied in everday life and underlying the competence at work. The main objective of learning mathematics at vocational schools is to provide the students with basic concepts to solve problems included in productive subjects.

The reasearcher tries to connect the materials of enumeration rule to the expertise competence, by understanding the enumeration rule, the students could distinguish permutation from combination by using the PMRI approach. A previous similar study was conducted by Putri (2003) at SMP Negeri 17 Palembang by using PMRI approach.the difference between this study and Putri's (2003) studywas this studywould be conducted at marketing Class XII of a vocational high school. Based on the School-Based Curriculum at SMK Negeri 5 Palembang, the enumeration rule is taught to the students of marketing class XII. The Subjects of this study were 8 students who had had the industrial work practice : 3 low-abbility students, 3 moderate-ability students and 2 high ability students. According to

Gordon (2006), Mulholland (2010), Benneti, Burton and Neson (2011), permutation can be taught through change-of-place games by using puzzle boards. Permutation and combination are part of the enumeration rule so barcodes are used to substitute for puzzle boards. The researcher thinks that barcodes are suitable media to use in this study.

Problem Formulation and Problem Solving Plan

Based on the description in the introduction, the problem of the study was whether the appropriate learning trajectory with barcode media could help students understand the concept of Enumeration Rule.

RESEARCH METHODOLOGY

Subjects were included in this study were 8 students of class XII Marketing SMK Negeri 5 Palembang , South Sumatra , Indonesia . This research activity has been carried out in the month of February 2016 the second semester of the third and fourth weeks of the academic year 2015/2016 . The method in this research is the development / design research. (Akker , J.v.d. 1999) type of validation study.

Design research aims to develop theories about the learning process and the way it is designed to support learning , develop LIT with the cooperation between researchers and teachers or develop a theoretical framework (Gravemeijer& Cobb , 2006; Gravemeijer&Eerde , 2009) . According to Bakker (2004) , Gravemeijer& Cobb (2006) , Gravemeijer&Eerde , (2009) design research consists of several phases : (1) preparing for the experiment , (2) teaching experiment in the classroom , and (3) conducting retrospective analysis.

1. Preparing for the Experiment

Design Introduction (Preliminary Design)

In the study design perspective , the main objective at this stage is to formulate local instructional theory that can describe and perfected while performing design experiments (Gravemeijer& Cobb , 2006) . Researcher pouring initial idea to begin activities like studying literature before designing a variety of learning activities for research and designing HLT.Selain , researchers conduct classroom observations , interviews with teachers to determine the circumstances and prior knowledge of students who are subject to this study .

a) Studying Literature

Some of the literature is used as research material about the opportunities that the rules of enumeration with a discussion of charging rules , mathematical analysis of curriculum materials on the topic of enumeration rules so that it can be established a provisional estimates consist of : strategy and thinking of students , PMRI , barcode and research design.

b) Designing HLT

At this stage, the first to perform designing HLT , learning activities designed sequence is conjecture / guesswork. Conjecture of HLT is dynamic and tailored to students' learning during the study and teaching repaired for his next experiment.

c) Pilot Experiment

The second stage is to implement the instructional design that has been designed in the first stage of exploring , knowing the strategy and thinking of students in learning the concepts of multiplication rule to the rules of enumeration . At this stage of the pilot experiment (cycle 1) consists of four activities undertaken . Here is an explanation of each cycle . The purpose of this research experiment is :

a. Examined the ability of beginning students.

At this stage , researchers are looking for students' initial ability to conduct debriefing and carry out pre -test on matters relating to the length measurement . These results are used as the basis of the depth of the students' ability to design instruksionalnya be more appropriate .

b . HLT initial adjustment .

The main purpose of cycle 1 is to test the initial HLT . The main target of this phase is to collect data to support compliance with the initial HLT . This stage is to get advice from and discussions with the model teacher . It is intended that this HLT can achieve the goal of learning goals for teachers more aware of the condition of the student that the sample in the study. The results of the pilot experiments are used to answer research questions , make conclusions and provides recommendations for how HLT developed for further research . Data analysis was conducted based on the data collection techniques used during pre -test and post-test , observation , interviews , documentation and triangulation .

2. Data Analysis Techniques

Design research is a qualitative study that data analysis is conducted qualitatively . Data analysis was performed by the researcher and work with mentors to improve the calibration of this study began preliminary design phase , a pilot experiment (cycle 1) , and teaching experiment (cycle 2)

a. validation

According to Bakker & Van Eerde(2012) , the validity of the research on data analysis broken down into two: internal and external validity . Internal validity refers to the quality of data collection and the level of validity of the reasons which led to the conclusion . Data triangulation between the video recordings , students' work, interviews and field notes contribute to the internal validity of the study. Testing and improving alleged in the HLT during preliminary teaching and teaching experiment also contribute to the internal validity of the study .

b . Reliability

According to Bakker & Van Eerde , (2012) , the reliability of external known as " trackability " or " traceability " , which means that the reader should be able to track or trace the lessons learned from the previous researchers and to reconstruct their study of the failures and successes , procedures followed , the conceptual framework used , danalasanuntuk particular choice must all be reported

1. In addition, the reliability analysis performed in this study is qualitatively using two methods, namely the triangulation of data and interpretation of the cross .
2. Triangulation Data : According to Bakker (2004) used data triangulation to see the correlation obtained from the data source in the form of field notes and observation sheets , documentation in the form of photos and video to track student learning plan
3. Interpretation Cross : Interpretation of the cross used to require expert judgment (supervisor) to provide advice on the obtained data such as video .

DISCUSSION

This study discusses only one cycle only. In the early stages of HLT pendesaianan there are four activities while after wawncara with teachers and diujcobakan models in pilot experiments to be 3 activity in experimental teaching (teaching experiment) . Changes in the amount of activity due to several reasons explained in the revised learning trajectory allegations

1. Preliminary Design (DesainPendahuluan)

In the early stages produce hypotetical Learning Trajectory (HLT) first as for the activities carried out by researchers is :

a. Literature

Before executing HLT researchers produced the study of literature in the form of standard content of the SBC 2006 has SK and KD to the subject of Opportunity . On the subject matter of the investigators restricted basic competence (KD) 2.1 . Describe the rules of enumeration , permutations , and combinations with the goal of students able to explain the rules of enumeration and can determine quickly and precisely settlement consisting of : Tree Diagram , Table Silang and pair sequence. Researchers also investigated the Barcode (Barcode) is often used in the field is already very broadbut the barcode that researchers described here is a barcode that is often used in the field of Marketing . The use Barcode been researchers as media with context when students carry Job Training Industry (Prakerin) and when students practice marketing in schools is the starting point in the learning process . Observations researchers did the students to carry out pilot experiments, and cooperate with the maths teacher who will serve as a model so that didapatlah 8 students with low ability 2 , 3 and 3 -skilled people of high ability .
Before the pilot experiment , the researchers collected data for the research subjects in order to get a grade for teaching experiment . The data collected in the form of timetables and discussion with the teacher models.

b .designing the HLT

HLT contained in the learning objectives for students , planned activities , and the alleged develop in students during the learning process submarine activity . Besides HLT as a guide in answering the research questions at this stage of restrospectiveanalysis , the researchers also designed a learning device in the form of pre -test , activity sheets and lesson plans and post-test .
In the early stages of HLT researchers designed pendesaianan No 4 activity after conducting interviews with the model teacher , pilot experiments, and discussions with the model teacher , he suggested activities 2 and 3 activities can be combined with activity 2 .
Researchers ask for referrals from counselors turned out to agree to the second activity combined with activity 3 , for the third activity is not eliminated but coupled so it is considered will not reduce to obtain optimal data and still in accordance with the purpose of research.

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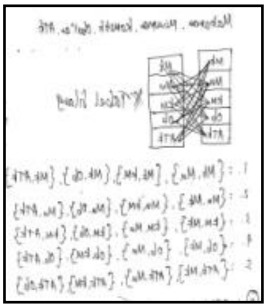


2. Pilot Experiment

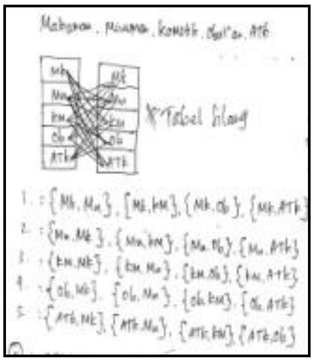
1) Preetest

In the pilot phase of the experiment there are four activities that are designed and tested in 8 students non- subject research . Students are selected based on the level of students' abilities are grouped randomly. The goal is to determine the ability and knowledge of students before the beginning of studying the subject matter sub Opportunity Rule Enumeration . Issues about student no.1 directly given the problem of how the method of enumeration rules of the specified object 5 into 5 elements desired . All students make up only two elements , a variety of methods exist that use a tree diagram , sequential pair and cross table .

Question :

„ Sebuah toko memiliki 5 macam produk yang terdiri dari produk makanan, minuman, kosmetik, obat-obatan dan ATK,disusun pada display masing-masing. Jika setiap produk tidak boleh menempati display yang sama, berapa banyak cara penyusunan produk yang berbeda pada toko tersebut?“

The figure below shows some of the strategies students .



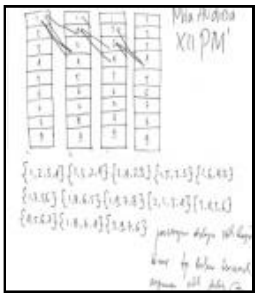
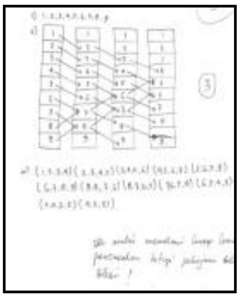
Picture 10

Of the three answers above answer on the image above in the method is correct , but the students do not understand interpret the objects specified 5 into 5 elements desired . All students make up only 2 elements . As for question No. 2 for about a all students can answer and the matter B to figure consisting of 4 digits if no number repeated there were almost there but not finished because there is confusion in compiling the figures further but for numbers 4 digits if the numbers are repeated all students no one answered .

Look at the image 11

"Berapabanyaksusunanangkaterdiridari 4 angkajikatidakadaangka yang berulangdanbanyaksusunanangkaterdiridari 4 angkajikaadaangka yang berulang "

Completion :

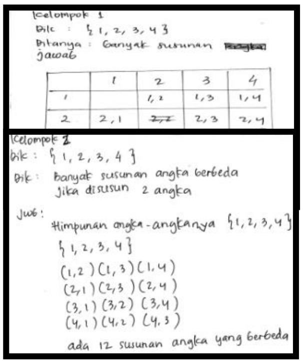



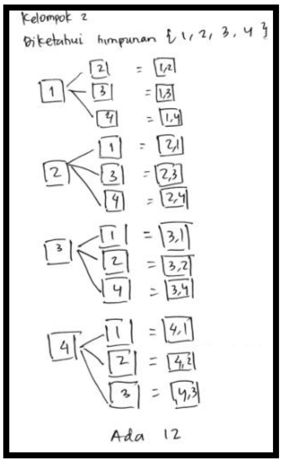

All the students said do not understand the intent of questions and do not know how to solve it, but according to the analysis of actual student researchers have been able to answer just because the new material so it can not complete the strategy they have done

2) activity 1

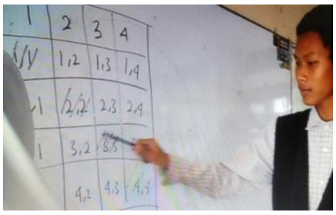
In this activity Barcode emerged as the starting point of learning . Here students practice entering numbers on the barcode printed on a variety of products into the computer application " SHOP Program " equipment that they use software that has been installed scanners , cash registers and a wide variety of products they had prepared as a matter of practice . Researchers working with marketing productive teachers in the use of equipment and equipment peraktek . Because the practice of marketing is to their regular activities the students looked excited as she asked each other if there is a product that can not be scanned .

From about the activities of one student there is no difficulty in writing the meaning of the numbers in the barcode as well as to question no . 2 students with discussion could finish. Researchers deliberately wanted to know the extent to which the student's ability to provide a matter which only make up 2 different numbers from the set of numbers { 1 , 2 , 3 , 4 } .



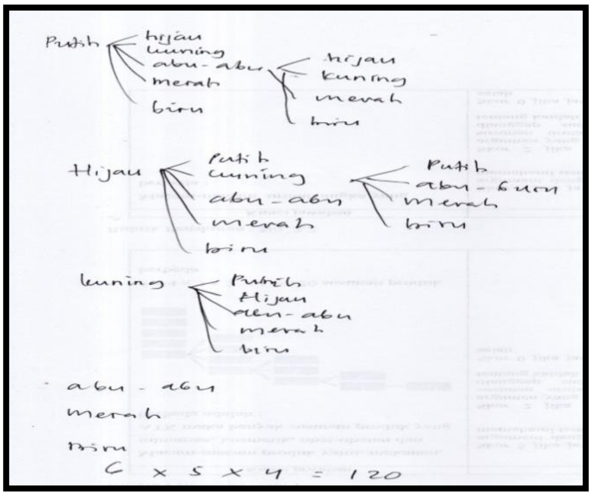


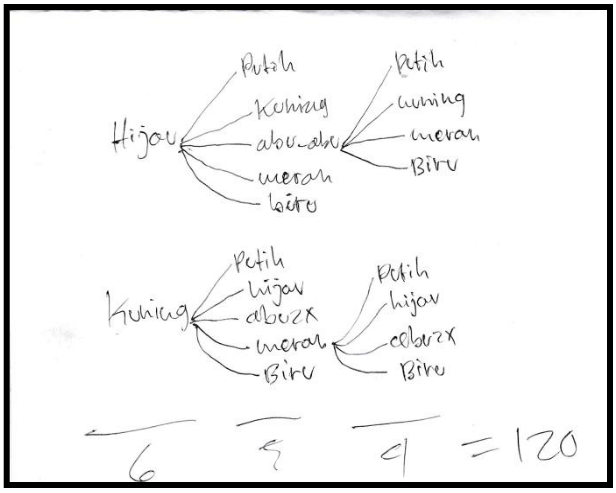
Researchers asked among the students to present the results of their discussion to the class.



3). activity 2

Before distributing the activity sheet 2 , the researchers recalled the previous material . Activity sheets 2 begins with a matter relating to the contextual activity but still associated with activities at the world pemasaran.dan researchers only provide reinforcement strategies used , fast and precise average student can begin to resolve the matter in context. There is a little problem students are still hesitant in deciding permisalan for LAS 1 consists of numbers being in a matter of contextual they are free to write their symbols.



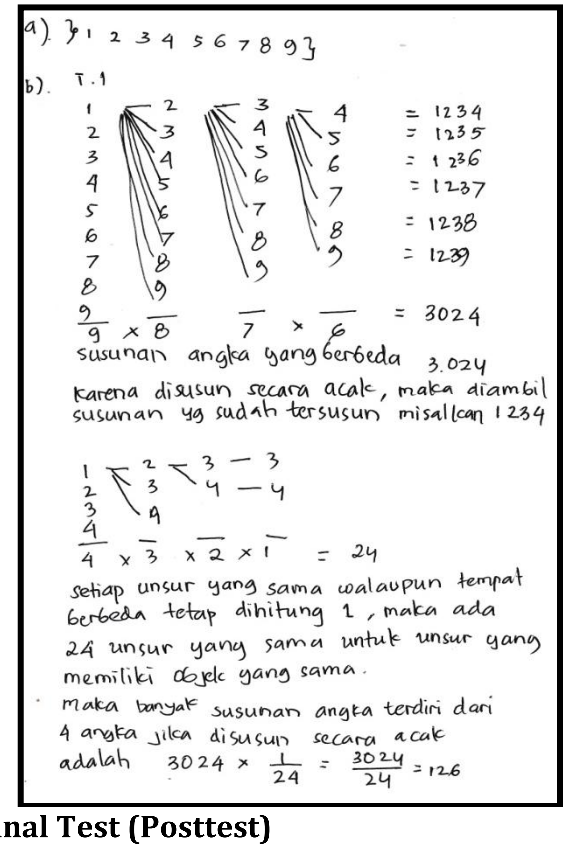


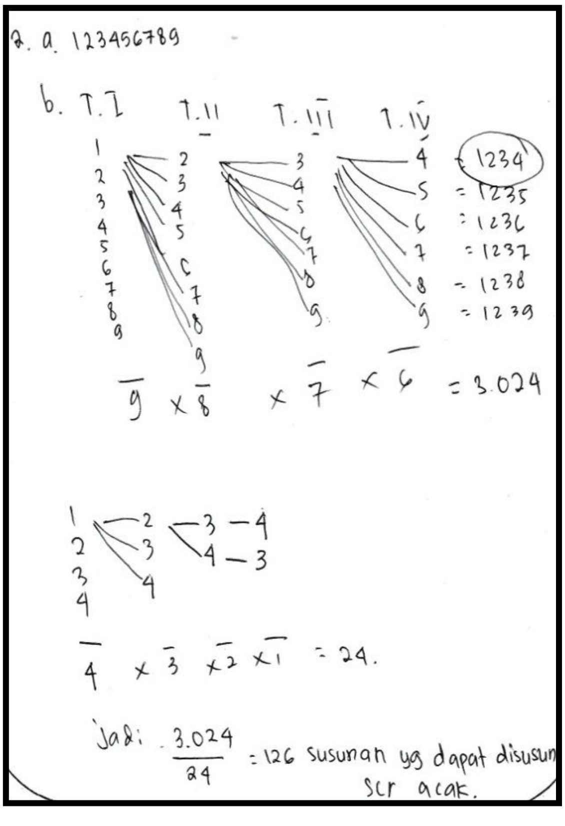
4). activity 3

In this activity LAS just talking about the rules of multiplication alone . Student activities mostly just record and then count on to keep using the product rule almost all students can do if there is trouble only if there are numbers that should be multiplied by fractions . But because it is still in the discussion group did not obtain any significant difficulties .

5). activity 4

Before procedding to activity sheet 4, the researcher reviewed the previous material, the strategies employed, and the multiplication rule included in the rule of enumeration. On activity sheet 4, the students were required to arrange n objects into r distinct elements if repeats allowed and if repeats not allowed. The students were also given questions in which n distinct objects were randomly arranged. The researcher expected the students to have the expertise complence to determine the composition of n objects into r distinct elements and then to multiply by one per r object into k different elements. In The arly stage, the students experienced some difficuly because in the previous meeting, the composition of n objects was different in which r same elements were considered different. However, in this activity, the compositionof n different objects consistingof r same element were considered equal. The researcher as a mediator in the discussion explained to the students to determine first the composition of n different objects comprising the same elements r devided by r different objects comprising the same elements r divided br r different objects into k same elements. The results of this meeting was that activity sheet 4 could be completed correctly and on average the students used the same strategy and method, that is tree diagrams, but the different was that the previous had the conditional rule to apply (the multiplicationrule), but if uncconditional and randomly determined, the concepts of multiplication and division should be used. This was in accordance with the researcher's conjecture that different response strategies would emerage





6) Final Test (Posttest)

The results of postest showed that most students improved their knowledge; only a small percentage did not. Many students showed progress. The students were able to present a question related to a contextual activity with non-numeric symbols to each strategy. On average the students had used a quick and accurate strategy byusing tree diagrams. When interviewed, the student gave the reason that it was easier to use a tree diagram, the errors in calculation were very small. If the result was strong, it was not because of the method used by due to carelessness. Not only could the students with moderate-ability and high-ability answer correctly, but also the students previously with low-ability could solve the problems and move into the categories of moderate and high ability.

CONCLUSION

Based on the results of the study, it can be concluded that the learning trajectory could help students understand the concept of probability by using barcodes as the media.

SUGESTIONS

Based on the result of the study using barcodes as the media, barcodes can help students to learn mathematics, and other researchers could develop better learning trajectories to teach probability by using barcode media and could improve the weaknesses of this study. Further researchers could also develop other media in order to achieve better mathematical understanding of probability.

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Needs Analysis for Cost Accounting Module Practice at Economic Educations Department of STKIP PGRI Sumbar

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Abstract

The background of this study is regarding to the perception of cost accounting students that the course is not easy to understand and caused the low grade of the students. Generally, this study aims is to answer how important of the availability of the module as tools for faculty and students in achieving the learning objectives of cost accounting, especially in the Economic department of STKIP PGRI Sumatera Barat. Type of this study is a qualitative research by conducting interviews with lecturers who organized the cost accounting course and students who have taken courses. This study noted any obstacles encountered in the field in connection with cost accounting course. The results showed that all cost accounting lecturers (four of them) expressed their strongly agreement on development of cost accounting module as additional teaching material. Furthermore the lecturers stated their difficulty in building the student understanding since they only use textbook and it need more exercises and case's examples to enhance their ability. The students stated also their needs to have cost accounting module as source for their independent study. Based on the result that 56 students (95% of respondent) strongly agree for the cost accounting module.

Key Word: cost accounting, module, needs

INTRODUCTION

Cost accounting is one of the compulsory courses taken by the students of economic education STKIP PGRI Sumatera Barat without exception. Cost accounting is a prerequisite course for students of economic education to take internship courses. This means that students are required to pass the first of the new cost accounting courses can take internship courses. The problem arises when the cost of accounting are considered students as subjects that are difficult to understand.

Teacher of courses cost accounting has been searching for the cause of his difficult students understand the material that exists on the costs and accounting courses based on searches conducted by the cost accounting courses pengampu turned out to be one of the causes of his difficult in material cost accounting is understood from sources of their learning . According to Sanjaya (2008:228) learning resource is everything that is in the learning environment is functionally can be used to assist in the optimization of the results of the study. Learning resources from cost accounting courses one of which was a textbook, but the large number of cost accounting text book which is a book of translations from foreign languages, which resulted in his language is less understandable. For material that should be hard to understand by students such as accounting cost there should be a practical guide and easy to understand. The guide is can be a module practice. Module lecture material itself is made up of a series of lectures and arranged specifically, clear and interesting content material, which includes examples of matter, and matter of exercises that can serve as learning resources for students. Nasution (2008:204) posited, "module is a complete unit in its own right and consists of a series of organized learning activities to help students achieve a number of objectives that are formulated with specific and clear. The module gives the opportunity to students to learn independently, as each student will use different techniques in solving a problem.

METHODOLOGY

In General, this research aims to answer how important is the availability of the module teaching tool for professors and students in achieving the learning objectives of cost accounting in the Economic Education STKIP PGRI West Sumatra. This type of research is qualitative research used by doing an interview to Professor mengampuh matah College accounting costs and students who have taken akuntans subjects related costs any barriers faced in the field with respect to Cost Accounting lectures.
study using a research design development with the development model of 4-D draft Thiagarajan, Semmel, and Semmel (Trianto, 2007:65). Model development consists of 4 stages which include: the definition (define); design (design), development (develop), and dissemination (desseminate). The stages that will pass only to researchers develop stage because bearing in mind the limitations of the time. Complete the procedures to be performed as follows1. Tahap Pendefinisian *(define).*

Activities performed at this stage is as follows:

a. analyze the syllabus, it aims to find out if the material being taught is in compliance with the basic standards of competency and competency courses.
b. Analyze textbooks cost, Accounting for rnelihat the suitability of the content of the book with the basic standards of competency and competency that must be reached students.
c. Mereviuw the literature associated with the development of modules, to see the references to Discovery-based learning modules and Terbirnbing.
d. interviews with colleagues and friends of students, aims to find out what barriers problems encountered in the field with respect to Cost Accounting lectures.

2.Design (design)

Module created consists of four parts that can be used for one semester, its parts namely: module 1 about the method of cost of goods order; module 2 of the price of the staple process, module 3 of the price of the staple Process Continued, and module 4 of the determination of the price of the staple Product and Byproduct. Each rnasing module contains a standard of competence, a description of the material, PowerPoint, terbirnbing, workout exercise self help, feedback, follow-up, and answer keys. Each module consists of several learning activities that are already adapted to the syllabus.

3. Development (develop)

at this stage of the action does is validation, test the practicalities and effectiveness of the module. a. the validation stage of
there are 2 kinds of validation used in the module, i.e. as follows:

1. The validity of the content, that is, whether the module has been designed in accordance with the syllabus of courses.
2. Validity of invalid constructs, namely suitability components module with indicators

. Modules that are already designed consulted and discussed with the validator. The validation of the module sheet filled in by the validator.

b. The practicalities of stage

At this stage limited conducted trials in all grades, i.e. session 2014 Economic education courses in western Sumatra PGRI STKIP taking Accounting courses semester Fees ganjil academic year 2015/2016. Practicalities associated with keterpakaian material of lectures by students and professors. According to Akker and Plomp (2001:62) *The material are said practical, if the teacher are able to use materials to execute their lesson in logical and coherent manner, without to many problems".*

1. According to Sukardi (in 2008:52) consideration of the practicalities of can be seen in the following aspects:
2. Ease of use, include: easy set up, saved, and can be used at any time
3. The time necessary in the implementation should short, fast, and is right.
4. The appeal of materials lectures against the interest of the students.
5. Easily interpreted by expert professors or lecturers of other
6. Have the same equivalence, so can be used as a substitute or variations,

On the study seen by the practicalities of conducting interviews and observations the implementation classes for ease of viewing, timing, and content of the module. a. effectiveness of Stage. At this stage of this test is performed to monitor the activity and results of student learning to know the effectiveness of the moduI that have been developed. If the module is not yet valid, practical, and effective then performed a revision on the part that is still lacking.

DISCUSSION

The courses Cost Accounting is one of the compulsory courses taken by the students of economic education STKIP PGRI Sumatera Barat. In addition, courses in accounting Costs be prerequisites for other courses namely courses internship. Material on cost accounting courses intended to prepare accounting reports and the use of accounting information. Discussion on material cost accounting system not only includes the collection, arrangement, processing, and reporting of economic data, but also the usefulness of accounting information in decision making. William (2009) the accounting costs used to complete and provide a discussion on the use of accounting information in planning and controlling the business system and in supporting the various management, including decision making that is strategically aimed at positioning the company sedemikan a way that can compete with the better. To be able to quickly understand the accounting costs required a module. Module lecture material is made up of a series of lectures and arranged specifically, clear and compelling content that includes material, PowerPoint, and a matter of practice. Nasution (2008:204) posited, "module is a complete unit in its own right and consists of a series of organized learning activities to help students achieve a number of objectives that are formulated with specific and clear. The module gives the opportunity to students to learn independently, as each student will use different techniques in solving a problem . Results of the study showed that of the four lecturers mengampuh cost accounting courses are all stated very agreed if the module is provided as a supplemental learning materials in a perkulihan accounting charge. The lecturer further mengampuh courses cost accounting in Accounting education courses STKIP PGRI West Sumatra States that during this time they are hard-pressed to make students understand the material they pass because they only use cost accounting textbook with examples case questions need further explanation given by Professor. A similar case was also submitted by the student. Students wanting practical books that they can use as an additional source of independent study. And of the 56 mahasisiwa which became 95 percent of the sample, expressed strongly agree if cost accounting lectures helped by teaching modules.

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THE DEVELOPMENT OF TEACHING MATERIALS BASED ON PROJECT ASSISTED BY MS.EXCEL TO INCREASE MATHEMATICAL COMMUNICATION ABILITY OF HIGH SCHOOL STUDENTS IN MEDAN

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Abstract

The purpose of this research is to produce the teaching materials based on project assisted by Ms.Excel to increase mathematical communication ability of high school in Medan. The type of this research is development research. The development of teaching materials based on model recommended by Thiagarajan is a model 4D (Four D model) which consists of four stages, namely: define, design, develop, and disseminate. However, at this stage of disseminate is not done, because this research was limited to feasibility of teaching materials in the form of lesson plan and student activity sheets. Before the teaching materials is used, the teaching materials must be validated by a validator expert. Validator experts in this research are consisted of three lecturers and two teachers who are experts in project-based learning and an expert in using Ms.Excel. The population in this research are all high school students at Asy-Syafi'iyahMedan Academic Year 2014-2015 which totaled 250 students. The sample in this research are all high school students at Asy-Syafi'iyah Medan class XI-1 natural sciences program which totaled 33 students. The sampling technique in this research using purposive sampling technique.The results of data analysis based on the validation of the validator with an average value for the lesson plan is 4.04 (valid category) and for the student activity sheets is 3.93 (valid category).In addition, the teaching materials used by students is feasible to increase students' mathematical communication ability. It can be seen from the N-Gain students' mathematical communication ability test is 0.72 (high category). So that it can be concluded that the teaching material based on project assisted by Ms.Excel said feasible to increase mathematical communication ability of high school students inMedan.

***Keywords**: Teaching Materials, Project Based Learning, Ms.Excel, Mathematical Communications.*

INTRODUCTION

Technological advance in the 21st century had made a difference positive in development of education in the world, especially in learning mathematics.Teachers, students, even though lecturers to be the achievements of technology that is growing rapidly in every year. Learning mathematics at the unit level of education should be able to adapt to the development of science and technology progress (Depdiknas, 2007: 1). To anticipate the development of science and technology is more advanced, then the learning of mathematics in the classroom needs to be reformed, in both teaching techniques and in the selection of appropriate learning media. Tasks and role of educators is no longer as informer (transfer of knowledge), but as a driving force learners to learn (stimulation of learning) in order to construct their own knowledge through various activities such as problem-solving, reasoning, and communicate (doing the math), as training vehicle for critical and creative thinking.

Communication is one of five standard processes offered by NCTM. The fifth standard process that is problem solving, reasoning and proof, communication, connections, and representation (NCTM, 2000: 4).Furthermore Ansari (2012: 12-13) says that: "Mathematical communication consists of, verbal communication (talking) and written communication (writing). Talking such as reading, listening, discussing, explaining, and sharing, while writing such as express mathematical ideas in the phenomenon through the graphics / images, tables, algebraic equations, or with language daily (written words)."

Correspondingly with the above opinion, Ahmad &Jazuli (2009: 207) says that: "the mathematical communication is the basic ability must be processed by mathematics practitioners and user during teaching-learning process and assessing mathematics". Thus, mathematical communication both as a social activity (talking) as well as the tools to think (writing) is the ability to obtain recommendation of experts to continue to be cultivated among students. Because of mathematical communication skills, a student could issue their ideas through written and oral.

However, reality has shown that a lot of common facts mentioned that mathematical communication abilityof high school students in Medan is still low. For example, high school students at Asy-Syafi'iyahMedan still classified in the low category. Based on observations conducted by researcher of the 40 high school students at Asy-Syafi'iyahclass XII natural sciences program, the results are as follows: there are 10 students (25%) who had a mathematical communication ability with high category, there are 13 students (32.5%) who had a mathematical communication ability with the medium category, and there are 17 students (42.5%) who had a mathematical communication ability with the low category. It is because of to many schools in the city of Medan that use teaching materials such as lesson plans and student activity sheets less attention to the development of students. Teaching materials used still impressed stiff, too much give the abstract questions and does not involve about as a result of application of learning mathematics. Besides, the use of technology as a tool or media support is also sometimes forgotten participated in the teaching materials used. Of course, if this was to be left is available continuously, then there is no doubt would be bad for mathematical communication ability of high school in Medan.

To overcome this problem, it is necessary a teaching materials mathematics that lead students to learn using the surrounding nature and technology as the media supporting the success in learning mathematics. So that students feel excited in learning mathematics.For example, the use of mathematical teaching materials through a learning model that invites students to develop talent in mathematics, which is a project-based learning model. Project-based learning is a model that regulate learning through specific projects (Thomas, 2000: 1).

Through the implementation of project-based learning model is expected to help improve students' mathematical communication. Reasons for the selection of project-based learning model because this model provides an opportunity for students to explore and cultivate various problems that occur in real life that led to the formation of a work or product results which will be presented in the classroom. Obviously that project-based learning model will greatly affect the quality of students' learning result obtained.

Steinberg (in Wena, 2009: 151) says that: "There are 6 strategies in designing a project called" The Six A's of Designing Project", namely: (1) Authenticity, (2) Academic Rigor, (3) Applied Learning, (4) Active Exploration, (5) Adult relationship, and (6) Assessment."

The use of the teaching material based on project who want to subjects in this research use technology assisted by Ms.Excelthat aims to increase math study results students on statistics matter.The use ofMs.Excel considered appropriate to increase the students' mathematical communication ability,because by using Ms.Excel students can easily translate a mathematical problem in graphs / charts different. As disclosed by Teixeira, et al (2009: 3) as follows: "With Excel one can learn while performing all calculation steps and easily creating graphical representations." Through mathematical teaching materials that use of project-based learning model assistedby Ms.Excel expected to help overcome all the difficulties of the students in learning mathematics, in particular the difficulty in communicating mathematically. So that led to a satisfactory learning outcomes. Besides, it is also expected to print a competent graduates.

Based on the discussion background above, researcher interested to write research with the title: The Development of Teaching Materials Based on Project Assisted by Ms.ExcelTo Increase Mathematical CommunicationAbility of High School Students InMedan.

RESEARCH METHODS

Population and Sample Research

The population in this research are all high school students at Asy-Syafi'iyahMedan Academic Year 2014-2015 which totaled 250 students. The sample in this research are all high school students at Asy-Syafi'iyah Medan class XI-1 natural sciences program which totaled 33 students. The sampling technique in this research used purposive sampling technique. Tashakkori&Teddlie (in Teddlie and Yu, 2007: 80) said that: "purposive sampling techniques involve; selecting certain units or cases based on a specific purpose rather than randomly". This research was conducted in SMA Asy-Syafi'iyah Medan is located at Jl.KaryaTani No.1 Medan Johor.

Type of Research

This type of research is the development of research. Teaching materials developed shaped lesson planand student activity sheets.The development of teaching materials based on model recommended by Thiagarajan(1974: 6-11)is a model 4D (Four D model) which consists of four stages, namely: define, design, develop, and disseminate.However, at this stage of disseminate is not done, because this research was limited to feasibility of teaching materials in the form of lesson plan and student activity sheets.

The stage of define is to determine and define the learning needs by analyzing the goals and limits of the material to be developed. At this stage, researcher only limit the material on statistics.The stage of design aims to design a learning tools, for examples: the preparation of the test as the reference benchmark, the selection of appropriate media, set the format of teaching materials, and making an early draft. At this stage the researcher made teaching materials such as lesson plans and student activity sheets. Researcher using project-based learning, and to selectMs.Excel as supporting technology.The stage of develop is the stage to produce the product development is done in two steps, namely: (1) expert assessment followed by a revision, (2) development trials.

Product development is validated by a validator which consists of mathematicians, namely lecturers and high school math teacher. The validity of the test carried out by giving questionnaires to the validators. The purpose of this test is to assess the validity of the achievement of the product in terms of validity of achieving scores above the specified standard.

Test effectiveness conducted by trying out the product to allhigh school students at Asy-Syafi'iyah Medan class XI-1 natural sciences program and measure the achievement of mathematical communication ability through matter competency test.

Data Analysis Techniques

Data analysis techniques used in this research is a descriptive analysis techniques. Quantitative data validation results were analyzed through several stages of determining the average score bothassessment result validatorsto lesson plans and student activity sheets on each indicator. The results of the assessment given by the validators is calculated by using the formulas proposed by Siagian (2015: 95) as follows:

a) Looking for an average per criteria of validators with using formula:

$$K_i = \frac{\sum_{h=1}^{n} V_{hi}}{n}$$

b) Looking for an average of every aspect with using formula:

$$A_i = \frac{\sum_{j=1}^{n} K_{ij}}{n}$$

c) Looking for the average total validity all aspects with using formula:

$$RTV_{BA} = \frac{\sum_{i=1}^{n} A_i}{n}$$

d) Determining the validity of the category with match an average total with the criteria of validity of instructional materials proposed by Khabibah (Siagian, 2015: 95) as follows:

$4 \leq RTV_{BA} \leq 5$ Very valid
$3 \leq RTV_{BA} < 4$ Valid
$2 \leq RTV_{BA} < 3$ Less valid
$1 \leq RTV_{BA} < 2$ Invalid

To see the increase of capabilities mathematical communication students in each indicator, can be calculated from the amount of the increase before and after learning that the calculated by formula normalized gain as follows (Bao, 2006: 917):

$$N\ Gain = \frac{PosttestScore - PretestScore}{MaximumScore - PretestScores}$$

With the gain index criteria as follows:

$NGain > 0{,}7$ High
$0{,}3 < NGain \leq 0{,}7$ Medium
$NGain \leq 0{,}3$ Low

RESULTS AND DISCUSSION

The test results of the validation by validators of the teaching material in the form of lesson plans can be presented in table 1 below:

Table 1. The Results of Experts Validation to Lesson Plans

Aspects	Indicators	The Number of Validators					Average Every Indicators	Average Every Aspects	Average Total
		1	2	3	4	5			
Format	a. The clear division of material	4	4	5	4,5	4	4,3	4,1	4,04
	b. The numbering system is clear	4	4	4	5	4	4,2		
	c. The room arrangement / layout	3,3	4	4	4,3	4	3,9		
	d. The type and size of the corresponding letter	4	4	4	4	4	4,0		
Language	a. The truthof layout	3.3	4	4	3,8	4	3,8	3,9	
	b. The suitability of sentence with a level of thinking and reading skills and the age of student	4	4	4	3,5	4	3,9		
	c. The simplicity of sentence structure	4	4	4	3	4	3,8		
	d. The sentence does not contain a double meaning	4	4	4	4	4	4,0		
	e. The clarity of instructions and directions	3	4	4	4,5	4	3,9		
Contents	a. The truth of the matter is grouped into logical sections	4	4	4	3	4	3,8	4,1	

	b. Activities of teachers and students formulated clearly and operations, making it easy undertaken by teachers in the learning process in the classroom	4	4	4	4,3	4	4,1		
	c. According with syntax of Project Based Learningmodel	4	4	5	5	4	4,4		
	d. According with Curriculum 2013 (a) There is a core competency, (b) There is a basic competence, (c) Indicators of basic competencies according with the competence to be measured, (d) The learning objectives include knowledge and skills competency. (e) Scientific approach is listed on the steps core activities, for example: 1) Observe the problems presented 2) Ask one group to friends or colleagues 3) Collect information 4) Associate the information obtained 5) Communicate the results of discussions in class (a percentage of the discussion) (f) There are draft authentic assessment 1) Assessment of attitude 2) Assessment of self 3) Assessment between friends (peer) 4) Assessment of skills and 5) Assessment of knowledge	4,5	4	5	4,5	4	4,4		
	e. The suitability of description of material according to curriculum 2013	4	4	4	4	4	4,0		

Based on the table 1 above, can be seen that the total average of the results of validation by validators to the lesson plans at 4.04 (valid category). Thus, it can be concluded that the teaching materials based on project using Ms.Excel in the form lesson plans be considered valid and can be used in the high school students in Medan.

Meanwhile, the test results of the validation by validatorson the teaching materials in the form of student activity sheets can be presented in table 2 below:

Table 2. The Results of Experts Validation To Student Activity Sheets

Aspects	Indicators	The Number of Validators					Average Every Indicators	Average Every Aspects	Average Total
		1	2	3	4	5			
Format	a. The clear division of material	3	4	5	4	4	4,0	4,0	3,93
	b. The numbering system is clear	4	4	4	5	4	4,2		
	c. The room arrangement / layout	3	4	3	4,8	4	3,8		
	d. The type and size of the corresponding letter	4	4	4	4	4	4,0		
Language	a. The truthof layout	4	4	4	4	4	4,0	3,7	
	b. The suitability of sentence with a level of thinking and reading skills and the age of student	4	4	4	3	3	3,6		
	c. The simplicity of sentence structure	4	4	4	3	3	3,6		
	d. The sentence does not contain a double meaning	3	4	4	3,5	3	3,5		
	e. The clarity of instructions and directions	3	4	4	4	4	3,8		
Contents	a. The truth of the matter is grouped into logical sections	4	4	4	3,3	3	3,7	4,1	
	b. According with the theory of constructivism learning	4	4	4	4	4	4,0		

	c. According with the ability to be measured, namely mathematical communication ability	4	4	5	4,5	4	4,3		
	d. According with the curriculum 2013 that is by using a scientific approach on every problem presented in the student activity sheet	4	4	4	5	4	4,2		
	e. The suitability of the material order based on curriculum 2013	4	4	4	5	5	4,4		

Based on the table 2 above, it can be seen that the total average of the results of validation by validatorson student activity sheets, which is 3.93 (valid category). Thus, can be concluded that the teaching material based on project assisted by Ms.Exceltostudent activity sheets said valid and can be used at high school students in Medan.

Meanwhile, testing an increase in the mathematical communication ability of students before and after using the teaching materials based on project assistedby Ms.Excel to test the mathematical communication ability, can be seen in table 3 below:

Table 3 . The Average Every Indicators The Mathematical Communication Ability of Students in Terms of Project Based Learning Model Assisted by MS.Excel

The Indicators of Mathematical Communications	The Number of Questions	Ideal Score	The Teaching Materials Based on Project Assistedby Ms.Excel			
			$\bar{X}_{Pre}$	$\bar{X}_{post}$	N-Gain	Category
Drawing	1	4	1,85	3,61	0,83	High
Writing	2	4	1,53	3,30	0,71	High
Creating a mathematical model	3	4	1,21	3,15	0,69	Medium
Explaining Procedure	4	4	0,76	2,91	0,66	Medium
The overall of Indicators		**16**	**1,34**	**3,24**	**0,72**	**High**

Based on the table 3 above, it can be seen that the value of N-Gain students' mathematical communication ability test is 0.72 (high category). The largest increase occurred in the drawing indicator that is 0.83 (high category) and the lowest increase occurred in the explaining procedure indicator that is 0.66 (medium category). So that it can be concluded that the teaching material based on project assisted by Ms.Excel said deserve toincrease mathematicalcommunication ability of high school students in Medan.

Research limitations

This research conducted have adopted the development of teaching materials with model 4 D (Four D Models), which consists of four stages, namely: define, design, develop, and disseminate. But, in the implementation of this research, only three stages are adopted and carried out, namely: define, design and develop. However, on stage-4 namely the disseminate, which is the stage of the use of teaching materials based on project assisted byMs.Excel which developed by a wider scale in other institutions, and aims to test the effectiveness of the use of teaching materials on learning activities teaching in a longer period of time, was not adopted at once implemented. This is caused by limitations of time, cost and effort to deploy teaching materials based on project assisted by Ms.Excel.

CONCLUSIONS

Based on a series of activities done, and referring to research results and discussion, so researcher could draw conclusions as follows:

1. The teaching materials based on project assisted by Ms.Excel of lesson plans said valid and can be used at high school students in Medan.
2. The teaching materials based on project assisted by Ms.Excel of student activity sheetssaid to be valid and can be used on high school student in Medan.

3. The teaching materials based on project assistedby Ms.Excelsaid deserve toincrease mathematical communication ability of high school students inmedan

SUGGESTION

1. For advanced researchers, the development of teaching materials based on project should be developed at the level higher education by involving different matter.
2. The use of teaching materials based on project can be modified not only by Ms.Excel and communication mathematical ability. It should be for the next study, researchers were able to modify the teaching materials with technological and mathematical abilities are different.
3. For the application of the product, the teachers should be attention to the characteristics of students in school when they wanted to use these materials.So that, the learning can achieve optimal results.
4. For advanced researchers, it is hoped to do research of this type until the final phase, namely the deployment phase. So that, four-D models are developed to be perfect.

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The Development of Mathematics Subject Equipment on Main Material of Cube and BeamsBased on Student Centered Learning Activities at Grade VIII of *Islamic* Junior High School.

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Abstract

In KTSP, teachers are expected to develop the subject of equipment based on real conditions in a school, nevertheless, emphirical condition shows that teachers are still dependants upon either books or student sheet from publishers. Besides, the teachers also get troubles with the development of the subject equipment. The aim of this research is to develop a student worksheet of cube and beams are valid, practical and effective for the students at islamic Junior High School. The research method is based on the Development Research approach. It is IDI's model (Instructional Development Institute). The research consists of three steps. They are Front-End Analysis, Prototype and Assessment. The activities of Front-End Analysis are to analyze mathematics curriculum especially for based materials , to analyze the mathematics text books, to review the literature about student worksheet approach, to interview the mathematics lectures and teacher of, and to analyze the students' characteristics. The Front-End Analysis result is prototype Worksheet cube and beams which will be consulted to experts. The practical activity is to try out the prototype at the students' SMP 1 Air Hangat. Then, the prototype validation is done by 2 (Two) expert of mathematics eduacation at MTs. The result of the research show that;(1) Student Worksheet of Mathematics cube and beams learning materials are valid (include content and construct validity) based on the point of view of experts, (2) the use of learning materials have been practical based on the point of view of observers, students and teacher, and (3) the learning materials have been effective which is indicated by the junior high school learning activities and the high motivation and students's achievment.

INTRODUCTION

Problems of education in Indonesia one of them is that there is wide gap between the knowledge of the students with the attitudes and behavior. Many students who know or knew the subject matter, but it is not able to apply that knowledge to improve the quality of life.

According to Dewey in Tina, (2005: 1), the true learning is more based on the exploration guided by mentoring, from the mere transmission of knowledge. Learning is individualized discovery education while providing opportunities and experiences in the search process information, solve problems and make decisions for themselves. Through the process of student-centered learning, the teacher changed the function of the teacher (teacher) become partners (facilitator).

The paradigm change the learning process that had been centered on the teacher (teacher centered learning) into a student-centered learning (student centered learning), the which is expected to encourage students to be actively involved in building the knowledge, attitudes and behavior. Through the learning process with the active involvement of students this means that teachers do not take the rights of the child within the meaning of true learning. In the process of student-centered learning, the students gain the opportunity and facilities to build reviews their own knowledge so that they will gain a deep understanding (deep learning) and ultimately to improve the quality of students.

Student-centered learning is now considered to be more in line with the external conditions present a challenge for students to be able to take decisions effectively to the problems they face. Through the application of student-centered learning, the student must actively partiscipate, constantly challenge to have a critical power, able to analyze and solve its own problems (Tina, 2005: 2).The challenge for teachers as a companion student-centered learning is the teacher must understand the concepts, mindset and learning strategies are used. To support the competence of teachers in the learning process student-centered, it is necessary to increase the knowledge, understanding, expertise and skills of teachers as facilitator. In this case is to facilitate the learning process of students.

The ability of teachers to make the learning device and select learning strategies is crucial in improving the quality of learning, because according to the curriculum is demanded then is Education Unit Level Curriculum (SBC) which give broad autonomy to schools and educational units, along with the device and the responsibility to develop a curriculum suitable to local conditions.In particular, in the learning of mathematics teachers are expected to understand how to provide a learning experience that is a good variety of experience mental, physical, or social, because the learning of mathematics emphasis on giving the concept and significance.

Based on the results of interviews with some of the students, there was information that the students' difficulties in learning mathematics because the learning process is still dominated by the teacher. Before appearing in front of the classroom teacher must prepare a learning device in accordance with the material to be taught. Learning device is a tool that can be utilized for the benefit of teachers learning process, either directly or indirectly, in part or whole. One of the learning tools teachers can use to support the learning process is the student worksheet (LKS).Readiness of the teachers have often used the services of the issuer to use teaching materials and worksheets.

LKS should contain structured materials, summaries and duties related to worksheets that are circulating today, instead of emphasizing the learning process, but most only contain a summary of the material. Researchers trying to create a device-oriented learning student centered learning to improve learning outcomes.

Referring to the problems faced, the authors are keen to carry out research entitled **"TheDevelopment of Mathematics Subject Equipment on *Main Material of cube and beams Based* on Student Centered Learning Activities at G*rade VIII of Junior High School*".**

Objective Development. The goal of this research is based on the formulation of the problem that has been formulated as follows:

1. Knowing validity Student Worksheet (LKS) Mathematics Students Oriented Student Centered Learning in Class VIII Islamic Junior High Academic Year 2015/2016.
2. Knowing practical validity Student Worksheet (LKS) Mathematics Students Oriented Student Centered Learning in Class VIII Islamic Junior High School Academic Year 2015/2016.
3. Assess the effectiveness of the validity of the Student Worksheet (LKS) Mathematics Students Oriented Student Centered Learning in Class VIII Islamic Junior High School Academic Year 2015/2016.

According Harsono (2005: 3), learning-oriented student centered learning is a teaching strategy that puts students as learners (subjects) active and independent, with the condition of psychological as an adult learner, are entirely responsible for learning, as well as being able to learn beyond the classroom, while according to Tina (2005: 4), learning-oriented student centered learning is learning by using a pair of perspective, which focus on individual learners (experiences, backgrounds, talents, interests, capacities and needs) can increase the motivation of learning and achievement for all learners.

Oriented learning student centered learning is a teaching strategy that puts students as learners (subjects) active and independent, while teachers switch the function of a teacher to be a partner and as a facilitator of learning (from the mentor in the center to guide on the side.

According to Tate (1993 in Hendra, 2007: 4), features-oriented learning is student centered learning: (a) Focus on the process, (b) Emphasis on knowing how, (c) Students work in groups / teams, collectively and collaboratively, (d) Ratings by various means, (e) Students actively construct knowledge from many sources, (f) Flexible learning activities and not always in the classroom, (g) he teacher acts as a facilitator, a resource and partner for students.

According Sulisrawiyani (2007: 6-10), the pillars in student centered learning, among others:(a)WorkingGroup.(B)Discussion(C) Presentation, (d) Writing, (e) Critical thinking.

There are five important factors to be considered in principle psychology student-centered learning, namely:

a. Metacognitive and cognitive factors that describe how students think and remember as well as depictions of the factors involved in the process of establishing the meaning of information and experience.
b. Affective factor that describes how the beliefs, emotions, and motivation affects the way a person receives a learning situation, how many people are learning and effort they did to keep learning.
c. Factors developments that illustrate how other people play a role in the learning process and the way people work in groups.
d. Personal and social factors that describe in social interaction, people will learn from each other and can help each other by sharing their respective perspectives.
e. Factors individual differences illustrate how the individual's unique background and capacity of each (Tina, 2005: 2-3).

Things that should be considered in student centered learning are:

a. Transfer of learning for students.
   1) Students learn from their own experience, not from giving to others,
   2) The skills and knowledge it expanded from a limited context (little by little),
   3) is important for students to know to what he learned and how he uses the knowledge and skills (Anonymous, 2006a: 2).
b. Students as learners
   1) Humans have a tendency to study in a particular field and a child has a tendency to learn new things quickly,
   2) Your child can easily learn something new,
   3) The teacher helps link between the new and the known,
   4) Assignment of teachers in order to facilitate meaningful new information, giving students the chance to discover and implement their own ideas and sensitize students to apply their own strategies (Anonymous, 2006a: 2-3).
c. Importance of learning environments
   1) Learn effectively it started from the student-centered learning. Acting teacher in front of class, work and directing teacher,

2) Teaching should focus on how students use their new knowledge. Learning strategies more important than the result,
3) Feedback comes from a true assessment process and
4) Foster a learning community in the form of group work (Anonymous, 2006a: 2-3)

LKS is the establishment of teachers to guide students in a structured, where activities are giving an incentive for the students to learn mathematics. Meanwhile, according to Majid LKS are sheets of tasks that must be done by the students. LKS usually contains instructions for students to do activities. It aims to guide students perform vigorous activity during the learning process. According Trianto LKS is a guide for students to undertake activities aimed learning implementation in order to guide the students conduct active operations refers to the basic competence.

So it can be concluded that the LKS is a guideline that has been structured so as to provide an opportunity for students to broaden understanding of the material to the learning objectives. These guidelines contain activities that focused and active. So that worksheets can be used as a guide for students in learning activities.

According Prastowo LKS has multiple functions in the learning activities which is as follows:

1. As the instructional materials that can minimize the role of educators, but rather to enable learners.
2. As the teaching materials that facilitate learners to understand the material presented.
3. As a quick and instructional materials for practicing the said task.
4. Facilitate the implementation of teaching to learners.

The general function LKS is a medium that serves to help students to improve their understanding of the material through a sequence of steps that have already been designed and the students can express their ability in solving problems.

Steps arrange Student Worksheet:(1) Doing curriculum analysis, (2) Develop a map of LKS needs, (3) determine the titles Student worksheet.The steps in the writing worksheets.First, formulating basic competence. In this case, we can do the direct formulation of the applicable curriculum, which is of Curriculum 2013.Second, determine the assessment tool.n this section, you should choose an appropriate assessment tool with models of learning and following the approach of the Basic Reference Rate (PAP) or Criterion Referenced Assessment Third, make up matter. In the preparation of worksheets, that must be considered are: 1) the basic competencies to be achieved, 2) the source material, 3) election support materials, 4) the selection of clear sentences and in accordance with the enhanced Spelling (EYD).Fourth, consider the structure of LKS.Structure in LKS include the title, learning instructions, basic competencies to be achieved, supporting information, tasks and measures LKS workmanship, as well as an assessment of the achievement of learning objectives.

To get worksheets that meet the criteria for a valid, practical and effective then there are things that need to be done. LKS development is divided into two main steps, namely 1. Determine the design development of LKS:

a) Size.Size in question are the measures that can help students write pen can who want to be written in LKS. For example the use of LKS paper size just right, not too small or too big.
b) The density of the page. In this section, the density of the page to note. For example in one page is not packed with writings because it will make students less focused on doing LKS accordance with the achievement of learning objectives.
c) The numbering.This numbering will make it easier to determine which one is the title number, subtitle and children subtitle of the material will be presented in the worksheets.

d) Clarity. This aspect is quite important in the exposure of the material as well as the sequence of steps listed in the worksheet. This is due to the order of these steps, then the student can perform activities in a sustainable and able to conclude the workmanship done.

Step-by-step development of LKS In developing LKS, then there are measures proposed by Prastowo that begins with finding a purposelearning will be breakdown in LKS, next is collecting materials necessary learning, composing elements or elements associated with development LKS, and the last is the re-examination and improvement of worksheets that are already developed.

So we can conclude that in the development of LKS there are some important points that relate to how to determine the design development of LKS.n the development of the LKS, then be guided to the restrictions specified. Therefore the need for measures to be seen LKS development in determining the sequence of steps to be carried out aiming to get LKS typed valid, practical and effective.

METHODOLOGY

This type of research is the development of research.LKS development model cube and beams by researchers in this study is to use the model IDI (Instructional Development Institute) and is based on the concept of development Asim. DI instructional development models apply the principles of systems approach. There are three major stages of a systems approach, namely define (define) or a needs analysis, development (develop), and evaluation (Evaluate). The three stages are connected to the feedback (feedback) to hold a revision. Asim forward four main steps in the development of research is the analysis of needs (needs asessments), product development, product testing, and dissemination. However, in this study the researchers have not reached the stage of dissemination

Procedure development: (a) the analysis stage front and back cover: material analysis, namely geometry of cubes and blocks, analysis of textbooks of mathematics, review about learning worksheets, interview with peers, learn about the characteristics of the students. b) Prototype phase include: validation phase, LKS validated by two lecturers and one teacher of mathematics. Phase practicalities of LKS do with the practicalities of the test steps by teachers and students. (C) the stage of assessment.

Data collection techniques and instruments in this research: expert validation, observation and questionnaires. Data analysis techniques were analyzed quantitatively and qualitatively, the information obtained from: interviews, validity analysis, test analysis practical LKS.

RESEARCH RESULT

A. Results of Phase Analysis Front-Rear (front end Analysis)

1). Characteristics Material and Beam Cube

Material analysis cubes and blocks based on the curriculum of the school year 2015/2016. The principle referred to in setting cubes and blocks of matter is that the cubes and blocks the most basic materials to continue the matter further. Researchers assign worksheets cubes and blocks that will be developed is the web of cubes and blocks, cubes surface area, surface area beam, cube volume, and the volume of the beam.

2). Characteristics of Students as Research Samples

Characteristics of the students were also analyzed which aims to see the students' ability in the field of cubes and blocks, and the ability of students in general. Characteristics of students as seen from socioeconomic background, parental education and school and cultural origin. To see the characteristics of the student interviews were conducted with students. This is done in addition to determining the subject of the trial, the use of worksheets, as well as a reference to develop assay / level of difficulty about as well as the use of language in the development of LKS.

From the results of studying the characteristics of students, researchers obtained data 3 test subjects small group of 30 students with a distribution comprised 8 (26.67%) of the low ability, 13 (43.33%) of the group is and 9 (30%) of the high group.

3). Characteristics LKS cube and Beams

LKS is the establishment of teachers to guide students in a structured, where activities are giving an incentive for the students to learn mathematics. LKS characteristics developed by the researchers is based on the modification of the characteristics of the worksheets developed by Rostina Sundayana.

LKS characteristic in question is:

a. Identity of the material which contains the principal and sub-topics that are discussed in LKS cubes and blocks.
b. Introduction containing a summary of the general to the students about the material that will be discussed in LKS. It also explained about the skeleton content of the material, this material relationships with the matter further.
c. The purpose of learning is situated in the introduction to inform the destination of the material we learned in that material.
d. Learning instructions that describe the steps that must be done in this LKS, thus providing convenience to students in studying.
e. Description of learning content that consists of descriptions of the content of the material based on the title of each LKS. At every critical part is shown biting the little black box contains mild short phrases is an important formula.
f. Summary contains a description of the learning content of each end of the learning activity that aims to measure the extent to which the material has reached the learning objectives.
g. Reading materials written at the end of each learning activity in each of LKS is intended to facilitate students' search and browse in order to deepen and develop the material contained in the LKS.
h. Key practice questions and answers are intended to measure the extent to which the material has reached the learning objectives.
i. After performing the steps in accordance with the above explanation, the designing LKS cubes and blocks. Furthermore, consulted with experts and LKS design content. After the draft was revised according to expert advice

B. Validity Prototype Results LKS

1) Results of Validation Experts

Prototype design results validated by 3 people validator. LKS validation results were judged by three people showed that the average validation LKS cubes and blocks as a whole was 3.63 with a very valid category.

The suggestions suggestions by validator on LKS is;

1. The purpose of learning is not in accordance with the indicators
2. There are some indicators that do not correspond with the matter in LKS

3. Pictures are made according to the contents LKS, so by looking at the cover of the students already know what the material to be studied
4. Guidelines for learning can be made in sentence directive
5. There are some problems on worksheets that are not in accordance with the answer key
6. Material LKS be made more specific
7. The great variety of letters for each title, sub subtitles
8. The reorganization of the layout or numbering and images
9. Desaign incomplete picture at LKS
10. In steps perlukisan image, include the images in accordance with the instructions

Suggestions advice given validator is used to improve LKS. After LKS was declared invalid by the three validators, then for this LKS tested. After the trial, LKS fix again and then get a good worksheets.

2) Results of Tests on Students

The trial is divided into two groups, small group trial and continued with field trials in larger quantities than. Small group trial conducted in three different student ability levels. The results of tests on a small group is not too much to get a revision. Revised given by the students tend to be on improving the format of writing is the writing of the letter is not a complete sentence, the numbering sequence is wrong.

After LKS tested on a small group, then LKS revised. Based on the results of the revision of the LKS back tested on a group of students in a limited trial. The number of subjects trial of 30 people with a variety of students. The trial results provide revisions are not many and almost the same small group trial. For students who belong to a group of smart provide a very good revision is improvement in the form of matter. The results of trials of the small group and fieldwork into prototype form II.

C. Practicalities of LKS Cube and Beams

After LKS revised based on suggestions validator as a prototype I then to look at the practicalities (used) LKS, LKS tested. The trial aims to see the practicalities (used) is used math worksheets cubes and blocks by students. Experiments to look at the practicalities of LKS done limited testing / field trials. Field trial was conducted on students MTsN Air Hangat totaling 30 people with various levels of ability. Selection of test subjects based on analysis of documents value and interviews with several teachers in MTsN Air Hangat.

Tests performed for six times face to face. To see the practicalities of learning tools that are used in the learning process is obtained through: observation (observation) to the learning process, the impression of the teachers and students during the learning process. The results of observations and interviews with teachers and students, it can be inferred by the observer about the practicalities of learning prototypes. For the assessment of the practicalities of learning observer can be shown in Table 10.

Table 10. Results of the practicalities Against Data Cube Math Worksheet And Beams

Object Assessed	Observer		Tot	%
	1	2		
LKS cubes and blocks are easy to use and understand	4	4,5	8,5	85
LKS cubes and blocks very useful to enhance the learning process	3,83	3,5	7,33	73,3
The use of targeted LKS / accordance with the principle of learning LKS	4,33	4,33	8,66	86,6
Time adequately designed study LKS	4	4	8	80

Students love of learning with LKS terliaht of the student activity	4,5	4,1	8,6	86
Students learn with LKS menyenagi seen from the students' motivation	4,5	4,6	9,1	91
Total	25,16	25,03	50,19	83,65

From Table 10, the percentage of the assessment results indicate that the observer ratings ranged between 73.3% -91%. In general appraisers argue that the use perangakat learning math worksheets cubes and blocks overall a very practical use. The LKS but they have slightly revised after execution limited trial.

D. Effectiveness LKS Cube And Beams

The assessment phase is to look at the effectiveness of math worksheets cubes and blocks. The observed effectiveness is student motivation, student activities, and learning outcomes cubes and blocks. Stage viewed effectiveness conducted simultaneously with the practicalities of the use of LKS see developed.

1. Students' motivation

   Motivation questionnaire given after students follow a learning process with LKS six times face to face. The questionnaire contains diligent facing difficulties, interest in learning, pleasure seeking and solving problems, mastery of the subject matter and their sense of respect and a clear goal.

   Based on the results of the students' answers to the questionnaire contained in appendix 4. So in general the students showed high motivation toward learning by using LKS cubes and blocks with an average of 80.8 with high motivation category. Thus, learning mathematics by using LKS cubes and blocks in Air Hangat MTsN schools in particular have been able to motivate students in learning mathematics.

2. Student activity

   Activities students when studying cubes and blocks by using LKS observed by 2 observers. The observation of the learning activities of students on cubes and blocks used instruments in appendix 6 summarized in Table 11.

Table 11. Results of Student Activities With Observations

No	Category observation of student activity Meetings	1st Meeting		2nd Meeting		3rd Meeting		4th Meeting		5th Meeting		6th Meeting	
		(%)	Category	(%)	Category	(%)	Category	(%)	Category	(%)	Category	(%)	Category
1	Students study the materials on LKS according to the instructions provided by the teacher	88,3	Excellent	86,3	Excellent	90	Excellent	100	Excellent	83,3	Excellent	75	Good

2	Students work on the problems that exist in LKS	76,7	Good	63,3	Enough	100	Excellent	83,3	Enough	100	Enough	96,6	Excellent
3	Students do a debriefing with teacher	83,3	Excellent	90	Excellent	83,3	Excellent	75	Excellent	93,3	Excellent	78,3	Good
4	Students do a question and answer session between students	83,3	Excellent	100	Excellent	90	Excellent	91,7	Excellent	71,7	Good	75	Good

From table 11 shows that the activity of the students at the meeting one looks at the category quite well, this is caused because the new students are first learning to use worksheets. So it is still in the adjustment phase in both the use of worksheets and models used. While at the meeting of the second and third categories had good looks, because students are getting used to using the worksheets other than that based on interviews with some of the students obtained information that the student has not entered the classroom was prepared on the subject of which there will be studied. At the fourth meeting, five and six students have completed worksheets well, but did question the student activity with teachers and among students has decreased. This is because students already prepared before the lesson begins.

3. The results of student learning

Learning outcomes observed in this study is the result of learning cubes and blocks students FY 2015/2016. Students who follow the learning process with the numbering LKS consists of 8 people (26.67%) of the low group, 13 patients (43.33%) of the group's ability moderate and 9 (30%) of high-ability group.

Table 12. Student Test Results

No	Students Who Earned Value ≥ 65	Students Who Earned Value ≤ 65
	23 students = 76,67 %	7 students = 23,33 %

From table 12 shows that the percentage of students who scored ≥ 65 is 76.67% of the students and refers to the criteria for the success of the learning outcomes that have been applied, it can disimpulakan the effective use of learning LKS classified categories were very successful. This is because by using worksheets, can facilitate students to become better. That the study results show how much ability that obtained by the students after receiving their learning experience.

In the study by using worksheets are also still a student whose grade below 65 is as much as 23.33% this disebabkabkan by the ability of students are still slow to understand the materials on LKS cubes and blocks. ANNEX V

CONCLUSION

1. Validity LKS cubes and blocks

   In result example learning device consisting of LKS cubes and blocks and valid evaluation tool according to experts reviewed from several aspects such as the content of learning tools and principles and characteristics of LKS development. Aspects which validated that the organization LKS, the format of writing, translation of materials, use of language and illustrations.
2. Practicalities of cubes and blocks

   LKS prototype cubes and blocks for students in the school MTsN Air Hangat already practically according to observers, teachers and students. LKS is easy to use, helpful, charming. In general, please follow the students' learning process by using this LKS.
3. Effectiveness LKS cubes and blocks

   Effectiveness observed in the implementation of this learning is activity, motivation and student learning outcomes. Based on the description and analysis of the data, the level of activity of immersion students learning process is very high. The student's motivation is also quite high. Student learning outcomes are higher than students who did not follow the study with LKS.

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DESIGNING "VOLUME CUBE AND BEAMS" MATERIAL LEARNING USING REALISTIC MATHEMATICS EDUCATION APPROACH IN CLASS V ELEMENTARY SCHOOL 015 / XI SUNGAI PENUH ACADEMIC YEAR 2015/2016

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Abstract

Students in elementary school requires a strong imagination to understand the material "Volume Cube and Beams". But sometimes the teacher presents the properties of cubes and blocks with only two-dimensional images on the board, whereas cubes and blocks are the three dimensions. This causes the students understanding the wake of three-dimensional as grasp two-dimensional figures. On the other hand, the lack of guidelines for meaningful learning because they do not use concrete objects (real). This study aims to get the learning path, which facilitates elementary school students to understand the material "Volume Cube and Beams" in a meaningful way. The research objective is achieved using the design research methods with three important phases, including phases of thought experiment, experiment instruction phase and retrospective analysis phase. Subjects were students of class V SDN 015 / XI Sungai Penuh. Realistic Mathematics Education (RME) approach will be the basis for the preparation of design context and learning activities in this study. Researchers came to the conclusion that the activity-based experience are successfullyto construct knowledge of students. Furthermore, this study recommends Realistic Mathematics Education (RME) approaches are used in material learning "Volume Cube and Beams" for students of class V SDN 015 / XI Sungai Penuh Academic Year 2015/2016.

Keywords: Realistic Mathematics Education (RME), Design Research, Volume Cube and Beams.

INTRODUCTION

In education, math has been applied since the SD / equivalent to high school / equivalent, and math are also applied in Higher Education. This marks a very important math concepts and plays a major role in life. Mathematics is a branch of science that is rational. In Islam, the math is not a stand-alone discipline separately, but rather stem from several other disciplines[1]. Kline said that mathematics is not knowledge alone to perfect for himself, but the math was primarily to assist people in understanding and mastering the problems of social, economic, and natural [2].

Learning math is a learning concept. The most important thing is how the students can understand the basic concepts in mathematics. In the learning process students are expected not only to listen, take notes and memorize material and formulas provided by the teacher, but students are required to play an active role in the learning activities, students should be able to think critically and argue in solving various problems in mathematics. Understanding the course of basic mathematical concepts, where we study mathematics starting from elementary school (SD).

Elementary mathematics learning is expected to occur reinvention (rediscovery). Rediscovery is to find a way of solving informally in the classroom. In mathematics in primary schools there is a link between the students' previous experiences with the concepts being taught. So expect the learning that occurs is that learning becomes more meaningful. According to Piaget in Heruman, elementary students are in a phase in which the concrete operational capabilities in the thought process is the ability to operate the rules of logic, although it is still bound to the object that is concrete [3].

Based on observations conducted by researchers at the beginning, learning of mathematics in class V SD No. 015 / XI Sungai Penuh just mechanistic and procedural. Students tend to memorize formulas and are not trained to understand concepts and solve problems with the critical, logical, careful and precise. Teachers should be able to create a learning process that can involve students actively and help associate the material with real life contexts they encounter, instead of presenting a formula that causes less meaningful learning. In order for students to think mathematically formation in accordance with the purpose of learning mathematics. Not only that, learning of mathematics is meaningless, because teachers still use conventional approaches and students are less listened to the teacher's explanation, there are students who noisier during the teacher explains and would rather cheat on training given by the teacher. Based on the interview most of the students do not like learning math. Aside from the above issues, the lack of linkages between mathematics learning in school to the real world (real) and the daily life of students that mathematics courses considered difficult subjects and students greatly feared. This certainly had an effect on student learning outcomes. Especially in the study of mathematics class V, there are material geometry that requires imagination firmly on the students, for teachers serving nature of cubes and blocks only the two-dimensional image on the board when the beam and the cube is a three dimensional or geometry, so that students understand the wake space such as understanding the flat wake.

It required the development of quality learning materials. One is learning to use the approach of Realistic Mathematics Education (RME). First developed in the Netherlands by Hans Freudenthal. Realistic Mathematics Education (RME) combines mathematical insights into what it is, how students learn mathematics and how mathematics should be taught. Students should not be seen as an object of study, but as a subject of study[4]. Realistic Mathematics Education (RME) using a real phenomenon and applications of the students in the learning begin. With a set of contextual questions, students are guided by teachers constructively until they understand math concepts learned. So from mastering this concept, students are expected to acquire good learning performance anyway.

PROBLEMS

Based on the background of the problem, the research problems can be formulated in the form of questions as follows: How to develop learning material of mathematics at the material geometrical approach Realistic Mathematics Education (RME) in class V Elementary School (SDN) 015 / XI Sungai Penuh?

RESEARCH METHODOLOGY

The research method used in this study is a research method Design Research and the 2type of research is qualitative. There are three phases in the design research of mutual good form cyclic processes in each phase as well as in the whole process of design research, the first phase of the thought experiment (preparation and design), the second phase instruction experiment (experiment teaching). After the teaching experiment results will be seen in the third phase for improvement theory (theory improvement). [4]

In this study, researchers will analyze the students' mathematical development by the material arithmetic operations on fractions. The study design that researchers use is to use Hypothetical Learning Trajectory (HLT) which will be revised at each meeting. HLT is used as part of what is called the cycle of teaching mathematics (Mathematical Learning Cycle) for one or two of learning, or even for more than two-learning. HLT can connect between theoretical learning (instructional theory) and learning experiment in concrete. HLT is used to guide the process of learning to the trial in accordance with the specifications of the material and learning hypotheses that have been determined in the form of HLT. [5]

To revise the instructional design phase is expected to minimize the weaknesses found in every meeting and learning can improve design productivity in mathematics at the material arithmetic operations on fractions.

DISCUSSION

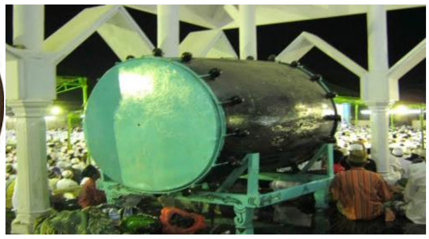
In the observation phase, the researchers looked at the early ability of students, then conduct an assessment of students' understanding of concepts by observing the learning process of students in mathematics which took place in the class that will be investigated by researchers. Researchers found that teachers still use the system lectures, discussion and exercises. Mathematics learning in the classroom is quite good but there are students who are not listening, cheating when doing exercise, and do not focus on learning.

At the time of being interviewed, most students think that mathematics is difficult, confusing the matter, and complicated in its completion. Disinterest is that students do not listen and not focus in learning mathematics. Researchers have opinions, learning fun and more hooked to the world around students will increase motivation and drive of students to learn and increase the activity of students in the learning process. Because students will be more aware and understand if they are looking for and find yourself learning the math concepts.

On Learning Implementation Plan, design learning researcher who will use Student Worksheet and learning media in the form of props cube and beams -shaped concrete objects. The media used in learning to discuss the initial concept of geometry.

At the HLT (Hypothetical Learning Trajectory) first, teachers and researchers asked students to classify and label the various geometrical been given, like the example below:





After the students can classify and label a variety of examples of geometry in everyday life, researchers explain the elements of beams and cubes using props in the form of a framework cubes and blocks, the elements referred to summarizes about the ribs, the field side, diagonal field, diagonal and diagonal field. Then, the researchers introduced the form of nets cubes and blocks using props in the form of cubes and blocks fractions which when opened turns into a flat plane is commonly called a web of cubes and blocks. Students do not just listen to explanations using props, but the students are also given worksheets that have researchers

prepare to see the extent of students' understanding of the material they have learned at the meeting.
Students are required to divide and solve problems on worksheets, so they can find the concept and meaning of geometry in everyday life.

At the first meeting, the learning process is not optimal. This is because students are still not familiar with the learning approach used. In addition, the classroom atmosphere is still awkward and students still familiarize themselves with researchers.
Based Hypothetical Learning Trajectory (HLT) suspect that students have difficulties in understanding the basic concepts of geometry. Most students simply fixated on the concept of geometry contained in textbooks, making it difficult to apply the concept in everyday life. In fact, many students think that waking up the same space with a flat wake, because teachers often explain the material got up space on the board alone, and rarely associate learning geometry with everyday life. Most students find it difficult to adapt to the approach Realistic Mathematics Educations (RME). Students are still confused and tend to be reluctant in expression using their own language.
Judging from the Student Worksheet which has been designed by researchers for the first meeting can be seen that the students have not been able to create a mathematical model of geometry in everyday life. Though the concept of geometry is a general concept used around them.The basic concept which states that the geometry is a structure bounded by several flat wake. Factors that causes poor students construct their own mathematical models that require intensive guidance of a teacher.
In addition, the first meeting stiff and awkward to make learning less effective. This is evident from the condition of students who are reluctant to ask questions or express their opinions. Less effective learning at the first meeting of researchers recognized the inability of researchers in conditioning classes and interact with students.
At the second meeting, the researcher recalls how the shape of the webs of cubes and blocks, then asks students to create webs of cubes and blocks. Students are divided into groups of 4-5 people. Students in groups carrying equipment such as scissors, glue paper, pencil and ruler and colored paperboard that has researchers prepared. Furthermore, students are directed to create webs of cubes and beams according to the size which has been determined by researchers using the tools that have been prepared. Once ready with nets that have been made, students in groups cutting the nets and webs formed into a cube and beam. After doing the above activities, students re-presented to the Student Worksheet in which there are problems associated with nets cubes and blocks, it is to see the extent to which students are able to understand the various forms of the nets cube and beams. Researchers hope that by learning that has been designed, students will be more active and motivated to learn, and minimize the shortage at the first meeting. The hypothesis of a safety pin at the

second meeting some students are able to distinguish which ones are the nets cubes and blocks, as it is usually glued to a single form.

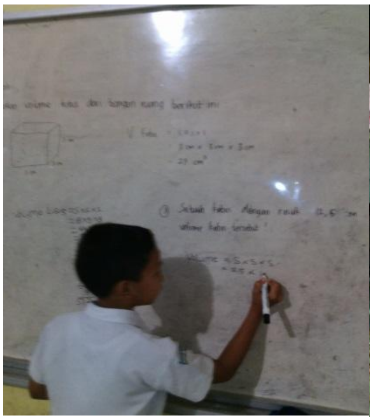
At the time of learning begins, the researchers conditioned the students to sit down in accordance with the group that has been shared. After they were seated in each group, researchers distributed a colorful cardboard paper and asked them to put the tools needed to create webs of cubes and blocks. After they set up all the equipment on the table, the researchers asked each group to create and cut webs they've done in accordance with the size that has researchers explained earlier. After they cut the cardboard, they folded as well as forming the nets into the form of beams and cubes.


After finding and making nets beams and cubes, they complete worksheets that have been shared. From the observations of researchers, students were more active and to adapt to the learning coud do.


The learning process at the second meeting went well and has increased from the previous meeting. Based on the researchers hypothesize that most students are able to distinguish which bore the nets cubes and blocks, as it is usually glued to a single form was proved right. However, the researchers designed a group learning difficulties in class condition. This is because most of the students after being in the group will become noisier and more chatting with classmates.

As for the third meeting, as for the material being taught is about the volume of a cube. In accordance with the principle of learning contained in RME approach is to direct the students in order to rediscover the formula, the researchers devised a problem with using unit cubes are put into large cubes.

Researchers at the third meeting hypothesis is that students can rediscover the formula volume of the cube. Researchers lead students to be able to rediscover the formula volume cube using props such as a large cube and small cubes as the cubes to find the volume. Once they understood, researchers gave some examples of questions and worksheets as a reference to see how much the students' understanding of the material presented.




Student motivation in learning mathematics is good, as indicated by the student active in solving the problem given by the teacher. RME activity appears once in the third meeting, because there was development of mathematical abilities of students are represented in the student answer sheets at the third meeting. At the Student Answer Sheet, in general, the students could answer correctly, because the numbers used in the form of numbers matter of course unit, making it easier for students to answer the questions that had been prepared earlier researchers. However only unit numbers less challenging students in answering the questions in the worksheets provided researchers.

Based on the reflections at the previous meeting, the method used at the fourth meeting of the numbers is by using a number of tens to find the volume of the beam. Learning activities are expected to run optimally and learning fun for students. Activity used is using the cube media unit that is inserted into a large beam, so that students can find a formula volume guided beam in his own way.

The learning process at the fourth meeting looks fun, but students with the ability of being seen lazy multiply the number of tens, accustomed find problems with unit numbers. Less than optimal learning in this meeting can be anticipated by giving matter with numbers alone unit, for elementary school students still stiff multiplication met three times in a row against the tens digit.

Achievement indicators of learning at the fourth meeting to do well for some students. This causes the result of the learning process is not spread evenly. Provision about the Student Worksheet (LKS) using matter with moderate level of analysis that can be solved properly by students. Mathematical ability of students actually progressed at every meeting just a little bit slower because of various obstacles, such as basic skills students need to have as described earlier plus another with less creation of a pleasant ambience in the classroom and students who tend to have less curiosity tall one.

Not to the creation of a high curiosity in students due to problems given in the introduction has not provided a challenge for students to find the answer. This is evidenced less creation of interactive mathematics learning. Yet according to Cobb and De Lange mentioned that one of the advantages of RME is as follows:

"The activity of teaching is called effective if realized in interactive learning ,; students explain the settlement they made, understand the settlement made other students, to express approval or disapproval, questioning the presence or the absence of alternative solutions, and reflection. "

Learning by using RME approach actually makes learning more fun because in addition to a student-centered approach also does not use language that is too formal. However, what happens on the field creating a tense atmosphere at the meeting of the first and second. This adds confidence that the researchers designed instructional design still requires revision. In addition to design quality, the personality of the teaching force is a factor that can not be eliminated role. The creation of a pleasant atmosphere or not is also influenced by the personality of the teacher.

The process was discovered during research possibilities reminiscent of the slow lorises process that has been portrayed in the book of enrichment for teachers in writing by Hernowo, in which quote Bertrand Russell, which states that:

"There is likely a reasonable ongoing learning in the classroom but in fact boring. There is a great possibility of teaching materials that feed all the students are from nature does so but actually teaching materials it needs to be linked to the everyday experience of our students to be something meaningful. There is likely also to teach us is correct but actually proteges who did not want to teach it-it all the time. "

Students 'mathematical development is not an instant product which can be obtained easily especially with instilling principles in their own way, only when using RME approach to students' understanding of the material can be better than the other approaches. This can be seen by differentiating between the student's understanding of student understanding during the observation and understanding of the students at the sixth meeting, where students are more aware of what and why of mathematics in particular materials and Limas Prisma was taught.

CONCLUSION

The mathematical ability of students in grade V SD No. 015 / XI Sungai Penuh using approaches Realistic Mathematics Education (RME) has progressed well, although not optimal. This shows that the design still requires revision better with the utilization of a more appropriate time. The activity-based experience are successfully to construct knowledge of students. Furthermore, this study recommends Realistic Mathematics Education (RME) approaches are used in material learning "Volume Cube and Beams" for students of class V SDN 015 / XI Sungai Penuh Academic Year 2015/2016.

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Learning The Concepts of Intersection & Union Set Using Cultural Context Palembang

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Abstract

Set is one of the foundations for studying mathematics and useful in the real world as well as a variety of situations in everyday life.The purpose of this study was to produce a learning trajectory can help students understand the material intersection and union through the culture of Palembang by using the approach of Indonesian Realistic Mathematics Education (PMRI).The methodology in this research is the type of research design validation study that discusses the first cycle of preparing for the experiment consists of preliminary design is designing Hypotetical Learning Trajectory (HLT) and Pilot Experiment (trial HLT) that has been designed.Subjects of this study consisted of six students of class VII Abdurahman bin Auf Islamic School HarapanMulia Palembang.In the learning process of students working in groups consisting of 3 students with academic ability level 1 high student, 1 student-capable medium and low-ability 1student.The collection of data used to use the recording, LAS, pre-test, post-test, documentation, interviews and records during the activity.From the data obtained in step 1 is Pilot Exsperiment, HLT designed PMRI approach produces students' learning trajectories in understanding the concept intersection-union of set.Realistic and real objects in the environment gives students a basic understanding to the students about intersection-union of set.
Keywords: *Set, Intersection, Union , PMRI, Culture*

INTRODUCTION

The set became one of the binder material or unifier between topics and form the basis of other math materials (Haryono, 2014) .One of the material that is difficult for students is intersection and union materials, the students do not understand and do not understand in determining sliced and combined. It is also difficult to understand the set because there are many symbols in the set to remember the students (Kusyanti, 2013). In connection with this, the use of context can be the start in learning math, so the student-centered learning (Student oriented) is expected to provide a pleasant atmosphere and ultimately the creation of activities that support effective learning objectives goals(Putri, 2009. Thus the researchers design learning materials for the intersection-union junior high school student in class VII. Learning is designed according to the theory with concrete material, a collection of material objects (Fiscbein, 1993; Baltsan, 1999). As for the concrete material using ingredients PempekKapalSelam and KueSrikayo.

Based on these preliminary, researchers design learning-slice joint use Palembang cultural context. The formulation of the problem is how the students' understanding of the material intersection-union with HLT designed through palembang cultural context? and How to track student learning in the learning intersection-union joint use Palembang cultural context, which evolved from informal stages to formal stages?

RESEARCH METHODS

The method used is the method of design research. The process of designing and developing the research design includes three stages, namely preparing for the experiment, experiment design, and retrospective analysis (Gravemeijer& Cobb, 2006). Cyclic process can occur repeatedly until the discovery learning trajectory that is a revision of learning material tested.

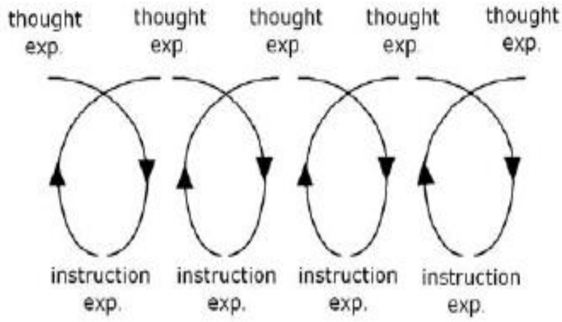


Figure 1. Process Cyclic Design Research (Gravemeijer, 2004)

The subject of this study is the first high school students IsamHarapanMulia Palembang. Where in the pilot phase of the experiment was 6 students of class VII Abdurrahman bin Auf divided into 3 capabilities, namely high, medium, and low.Phase of this study, namely (1) preparing for the experiment, the main purpose of this phase is to implement the initial idea derived from the study of literature before designing learning activities, (2) design experiment, the implementation phase of the design is done after all the preparations were made, (3) restropective analysis, analyze the data that have been obtained to determine whether to support or not in accordance with the conjecture that has been designed.

RESULTS AND DISCUSSION

In the process of learning that takes place consist of several activities. Before and after the activity carried out tests to determine the beginning and end student comprehension abilities. The series of activities such activities consist of:

Activity 1: Understanding the concept of intersection-union

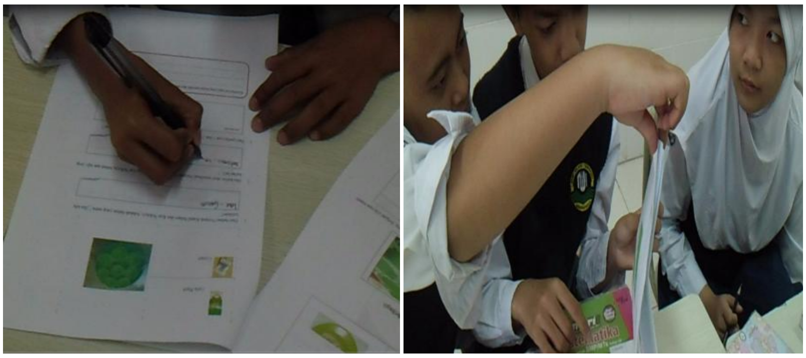
a. Learning Objectives in activity 1

The objectives outlined in the activity of 1 are: students can understand the concept of a combined set of slice-by using ingredients pepperoni pizzas and baking ingredients srikayo. So that students can understand the concept of a combined set of wedges.

b. Discussion

In the first activity the students are introduced materials pempekkapalselam and Cake Srikayo through slideshows (However, when the study will begin there is a problem with the LCD in class Rahman bin Auf and can not function properly, so that researchers convey feedback to students about the materials used in the manufacture of submarines and Cakes pempekSrikayo) and also on the LAS students. After watching and listening to the explanation from the teacher. Students and members of the group noticed one by one material diperlikan to make pempekkapalselam and Cake Srikayo then the students to investigate the two materials are the same whether there is any material or not.

Here's a picture of students discussing the LAS 1, can be seen in Figure 2



(a) (b)

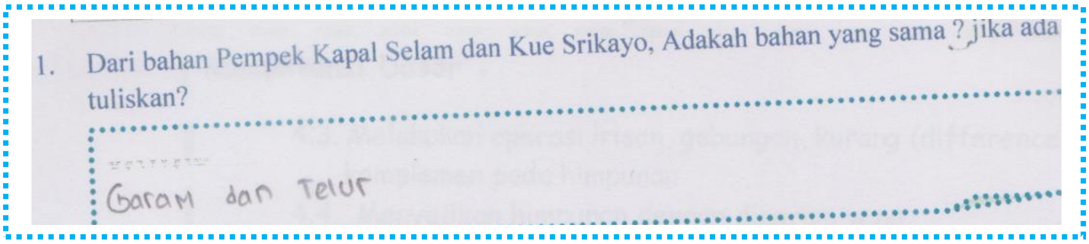
Figure 2 students discussed finish LAS 1

Based on the figure 2 students were able to discuss and identify the ingredients are the same Which of Pempekkapalselam and Srikayo. The purpose of this activity is that students can understand the concept of aintersection-union through materials pempekkapalselam and cakes srikayo.

Dialog specify the same material

Teacher: "Problem number 1 son what he said?"
Student 2: "From the material pempekkapalselamand cakes srikayo is there the same material, if any write?
Student 4: "yes, have"
Student 5: "yes, have"
Teacher: "There is. Any danger? "
Students 4 & 5: (Reread LAS 1)
Student 4: "eehmmm?
Student 5: where is ....
Student 2: (taking LAS of students 4 and 5 students). "Water and Salt"
Teacher: "Then let alone the same?"
Student 5: "Water not have in here"
Students 4 & 5: "Just be salt samo egg"
Teacher: "Ok. Write "

Here is a picture 3, examples of the students' answers LAS suswa 1 that has been done, namely:



1. Dari bahan Pempek Kapal Selam dan Kue Srikayo, Adakah bahan yang sama ? jika ada tuliskan?

Garam dan Telur

Figure 3 Sample Answers Students LAS 1 No. 1

draw conclusions from the activities that have been carried out. The results of the students' answers can be seen in Figure 4, below:

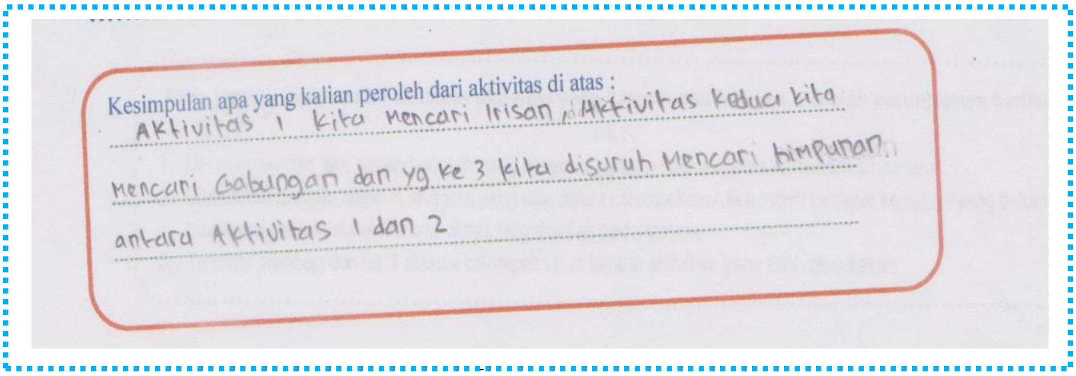

Kesimpulan apa yang kalian peroleh dari aktivitas di atas :
Aktivitas 1 kita mencari Irisan, Aktivitas kedua kita mencari Gabungan dan yg ke 3 kita disuruh mencari himpunan antara Aktivitas 1 dan 2

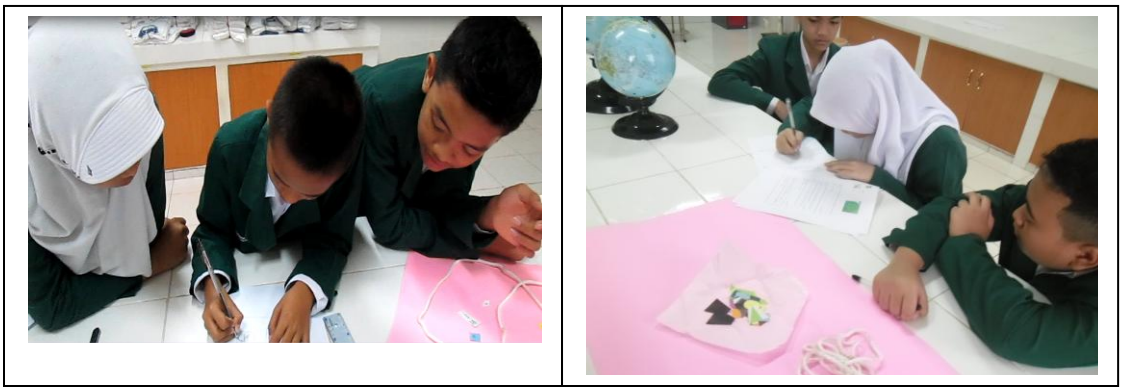
Figure 4 Sample Answer Student LAS 1 No. 4

Based on the answers in the figure 4, students are able to deduce what they have done. Although still not right in the language of mathematics.

Activity 2: Presenting slices and the combined set of the second set with a Venn Diagram
a. Learning Objectives in Activity 2
The goal in this second activity for students to present the slices and the combination of two sets with Venn Diagram

Student 1: "Here I who write, still remember."
Students 6 & 1: "(see the work of students 1)
Student 1: "srikayonyo havecoconut milk?"
Students 6: "(helps to check one by one material)." salt, water "

Figure 5 Students Cooperate on Activity 2

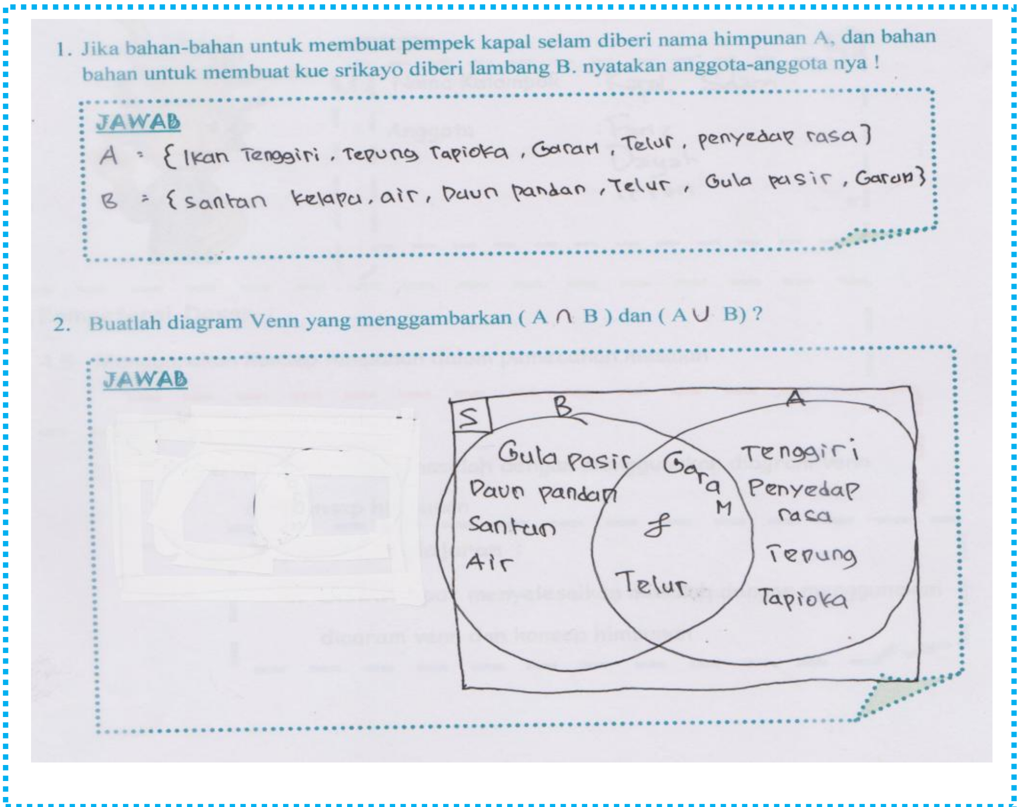


From that show activity of students using ingredients pempekkapalselamand cakes srikayo. When students answer the question number 2, students are confused. What to do with origami paper to ingredients pempekkapalselam and cakes srikayo. Therefore, the teacher provides guidance to help students, such as the transcript of the conversation below:

Student 3: "what we do? (confusion), mackerel (holding origami paper)".
Teacher: (Teacher directs students to use origami paper, which has holding) "now find origami paper representing mackerel fish".
Student 3: "This ismiss (while to see origami paper chooses)".
Teacher: "ok created, let alone then?"
Student 3 & 5: "tapioca starch".

Teacher: "Now make flour is".
Student 4: "that this be na".
Student 5: "oooooooooooo ....that right
Teacher: "then?
Student 3: "salt, eggs ....

Student difficulties in working Question 2 on the activity of these two is about origami paper, look at the transcript of the conversation that. Students are confused to use it when it had been equipped with manual labor but also the student has not understood, so the editor of this activity improved performance. Problem number 2 has to do with the previous problem. Therefore, when students ask the teacher directly ask students to pay attention to return on their answers to previous questions. Then menggirig students to use origami paper to solve the number 5.
Here are answers to students for activity 2:


1. Jika bahan-bahan untuk membuat pempek kapal selam diberi nama himpunan A, dan bahan bahan untuk membuat kue srikayo diberi lambang B. nyatakan anggota-anggota nya !

JAWAB

A = {Ikan Tenggiri, Tepung Tapioka, Garam, Telur, penyedap rasa}

B = {santan kelapa, air, Daun pandan, Telur, Gula pasir, Garam}

2. Buatlah diagram Venn yang menggambarkan (A ∩ B) dan (A ∪ B) ?

JAWAB

From the pictures 5 can known to students already know in saying that members in set. Based on this it can be concluded that the use of cultural context Palembang help students understand intersection-union set together with the presentation in a Venn diagram.

Activity 3: Resolve issues related to the concept of intersection-union set
The HLT activities Resolving issues related to the concept of sets, from each activity is described purposes, prior knowledge, descriptions (learning), a conjecture of student thinking and reflection.
teachers guide students to resolve such issues as the conversation the following:

Teacher: "Why, son, number 4 there were not understand?"

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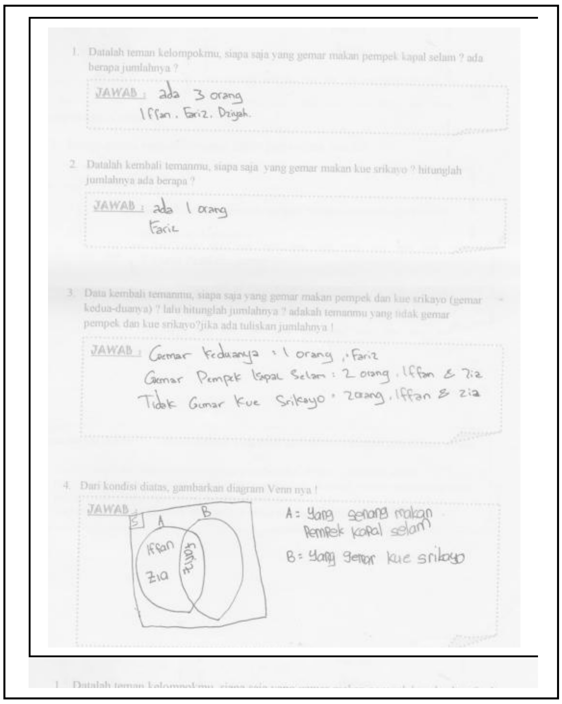
Students 3,4,5: "a little bit of (advance confused)
Teacher: "What the intent of about 4?"
Students 3,4,5: "(A pause)" ....
Teacher: "Try to read first because".
Student 5: "(read about)", of the above conditions, draw diagrams Venn? "
Teacher: "Which the above circumstances?"
Student 3 & 5: "1,2, and 3".
Teacher: "and then what to do with?"
Student 5: "depicted (grinning ☺)
Teacher: "yes described, good job son"

Here are answers to students on three activities:



1. Datalah teman kelompokmu, siapa saja yang gemar makan pempek kapal selam ? ada berapa jumlahnya ?

JAWAB : ada 3 orang
Iffan. Fariz. Dzigah.

2. Datalah kembali temanmu, siapa saja yang gemar makan kue srikayo ? hitunglah jumlahnya ada berapa ?

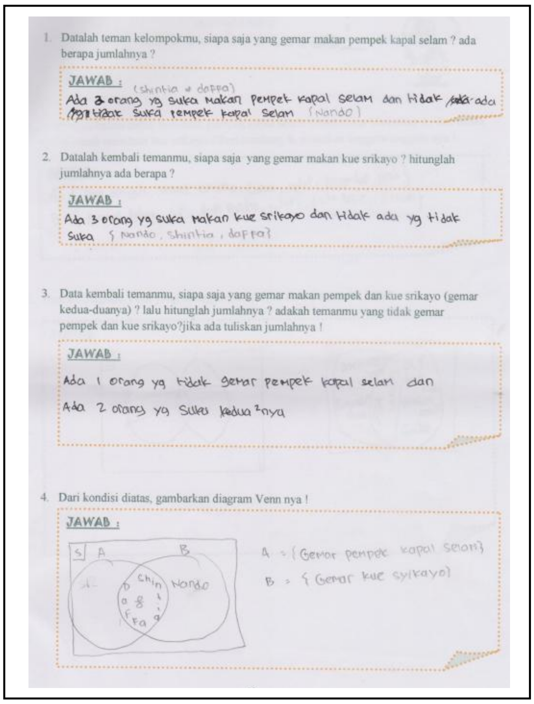
JAWAB : ada 1 orang
Fariz

3. Data kembali temanmu, siapa saja yang gemar makan pempek dan kue srikayo (gemar kedua-duanya) ? lalu hitunglah jumlahnya ? adakah temanmu yang tidak gemar pempek dan kue srikayo?jika ada tuliskan jumlahnya !

JAWAB : Gemar keduanya : 1 orang, Fariz
Gemar Pempek kapal Selam : 2 orang, Iffan & Zia
Tidak Gemar Kue Srikayo : 2 orang, Iffan & Zia

4. Dari kondisi diatas, gambarkan diagram Venn nya !

JAWAB :



1. Datalah teman kelompokmu, siapa saja yang gemar makan pempek kapal selam ? ada berapa jumlahnya ?

JAWAB :
(shintia & daffa)
Ada 2 orang yg suka makan pempek kapal selam dan tidak ada yg tidak suka pempek kapal selam {Nando}

2. Datalah kembali temanmu, siapa saja yang gemar makan kue srikayo ? hitunglah jumlahnya ada berapa ?

JAWAB :
Ada 3 orang yg suka makan kue srikayo dan tidak ada yg tidak suka {Nando, Shintia, daffa}

3. Data kembali temanmu, siapa saja yang gemar makan pempek dan kue srikayo (gemar kedua-duanya) ? lalu hitunglah jumlahnya ? adakah temanmu yang tidak gemar pempek dan kue srikayo?jika ada tuliskan jumlahnya !

JAWAB :
Ada 1 orang yg tidak gemar pempek kapal selam dan
Ada 2 orang yg suka kedua²nya

4. Dari kondisi diatas, gambarkan diagram Venn nya !

JAWAB :

Figure 7 Example Answer Students in Activity 3

Based on the pictures 7 and on transcripts , students are able to solve problems that connected with the concept of sets, continues to see the work it can be concluded that students have understood the students' answers although still not perfect. After the completion of activity 3 activity, and then do the next activity class presentation by the representatives of students and learning concludes today. Teachers with students carry out reflection, with this activity, students better understand the material intersection-union set.

CONCLUSION

Based on the results of the discussion that has been described previously, it can be concluded that the Hypothetical Learning Trajectory which has been implemented in this study has been Tracks Learning (Learning Trajectory) in the first stage and then will be applied at the stage berikkutnya that in the second stage of teaching exsperiment, which can help improve students' understanding of the concept of intersection-union and resolve problems related to daily life associated with intersection-union set.

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THE DEVELOPMENT OF LEARNING TOOLS BASED ON MODEL ELICITING ACTIVITIES (MEAs) APPROACH TO IMPROVE THE PROBLEM SOLVING ABILITY IN MATHEMATICS FOR JUNIOR HIGH SCHOOL GRADE VIII

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Abstract

The one purpose of mathematics learning is that students have problem solving ability. But in reality, the student's problem solving ability was still low, Because The students difficult, to understand the real life problems of mathematics. Therefore, students should get the learning tools that can improve Reviews their problem solving ability. One of the Efforts is to develop mathematics learning tools based on Model eliciting Activities (MEAs) approach. The purpose of this development is to produced learning tools are based on MEAs approach validity, practicality and effectiveness criteria. The development of research is conducted using Plomp development models, that Consist of three phases is preliminary research, development or prototype phase and the assessment phase. In preliminary research, conducted researcher curriculum analysis, analysis of needs, analysis of student's, and analysis of concept in mathematics. In the development or prototyping phase to design lesson plans and worksheets for students based on MEAs. In this phase, a formative evaluation be implemented namely its own evaluation, expert review, one to one small group and field evaluation test. In the assessment phase, practicality and effectiveness tests were done in a limited scale. The data is of the practicality were gotten from the questionnaire distributed to the teachers and students. The effectiveness were seen from the final test of the students to improve student problem solving ability.
Keyword: *Model eliciting Activities (MEAs), problem solving ability.*

INTRODUCTION

Mathematics is a field of study that has an important role in education. Through the study of mathematics learners equipped with a variety of mathematical ability, logical thinking ability, critical, analytical, systematic and creative, as well as the ability to cooperate. One of the important mathematical ability possessed by learners are problem-solving abilities. Problem solving ability is a series of capabilities that empower individual learners become independent and able to cope with any problems. In reality there are many students who have difficulty in solving mathematical problems, particularly on matters such as word problems or questions that require high analysis.

Based on observations made in some schools seen that the RPP developed yet facilitate learners in using the mindset is to improve problem solving skills of learners. In addition to the LKPD used these schools already contains matter briefly, some example problems and questions that must be done students. But the questions provided in LKPD still routine matters. The LKPD still contains questions that can improve thinking ability of students, resulting in the problem solving ability of students is still low. In addition RPP have not as yet provide a space for students to build their own knowledge and improve problem solving abilities.

Learning in school still be optimized to improve the problem solving skills of learners. One way to do is through the approach of *eliciting Model Activities* (MEAs) were found by Lesh and Doerr (2003) [1]. The process of learning to use MEAs started by giving a realistic problem with the aim that students can easily understand the problem. Then is an activity created a mathematical model through modeling stages starting from simplifying the problem came to interpret the results. Learning process by using these MEAs approach, demanding the students work in small groups consisting of 3-4 students (Chamberlin: 2008) [2]. so that through the stages that exist in the MEAs is expected to improve students' problem solving abilities.

Based on the problems described above, it is necessary to develop learning tools such as lesson plans and LKPD math activities provides an opportunity for students of class VIII SMP build his own knowledge and to develop problem solving skills of learners. Therefore, in this research will be designed devices MEAs based learning approach to improve problem-solving abilities of students at class VIII SMP. Problems presented in realistic learning is an issue close to the lives of student, which is expected to encourage the creativity of learners, especially in terms of problem-solving.

Formulation of the problem in this research is how the software development process and results-based approach to learning mathematics MEAs are valid, practical and effective way to enhance the creative thinking abilities of students of class VIII SMP. The purpose of this research is to produce devices based approach to learning mathematics MEAs are valid, practical and effective way to improve problem-solving abilities of students of class VIII SMP. In addition this research are expected to be useful for teachers and students as an additional learning tool that can be used in the teaching of mathematics in schools. The results of this study in the form of RPP and LKPD designed to follow the steps and principles of MEAs based learning approach.

MEAs found by Lesh and Doerr (2003). MEAs are learning approach mathematics to understand, explain and communicate mathematical concepts contained in a grain problem through mathematical modeling. The principles in the approach of MEAs by Chamberlin and Moon (2005) [3] (1) The Reality Principle, (2) The Model Construction Principle, (3) The Self-Assessment Principle, (4) The Construct Documentation Principle, (5) The Effective Prototype Principle, (6) The Construct Shareability and Reusability principle.

RESEARCH METHODS

This study was designed using research Ploomp development model. On the development of the three stages will be used on the model Ploomp. The first stage is the initial phase of the investigation by conducting a needs analysis, curriculum analysis, analysis of Siwa and analysis concepts. Needs analysis aims to determine the basic problems that required in the development of learning tools. Needs analysis phase is done through the collection of information in the form of observations and interviews with teachers at several schools.

Then, analysis of the curriculum in the national education system governed by the National Education Standards Agency (BNSP). At this stage of the review of Curriculum 2013 syllabus, lesson plans and teaching materials for Mathematics. Curriculum analysis is necessary to study the range of material, learning objectives, selecting appropriate strategies as a basis for developing LKPD (Worksheet Students) is expected. Later analysis of learner aims to see the characteristics of learners include: age, motivation of the subjects, academic ability, psychomotor and level of maturity. Behavior and characteristics of learners is very necessary to know the quality of individuals that can be used as guidance in lesson planning. Another thing in the analysis here is LKPD like what is needed by learners, including: whether learners want LKPD in learning, the preferred color, size LKPD desired, whether in the LKPD learners prefer contain images or animations. One final analysis of the concept. Analysis of the concept is the identification of the main concepts that will be studied by learners and systematically arranged in the order of presentation

The second stage is the *prototype* phase. In this stage is to design software development teachings MEAs mathematical *approach.* Then proceed with *self evalua-tion* by researchers and colleagues. The results of the analysis and revision based on *self evaluation* will proceed with the validation that five of the validator.

After being revised based on suggestions validator and declared valid learning tool will be followed by one-to-one evaluation. One-to-one evaluation will be done by three students with different abilities, namely high, medium and low. Then the next stage is a small group evalution which will be followed by six to nine students. At this stage it would be the practicalities of mathematics learning tools on a small scale. The results of the analysis of small group evalution will be tested in a large group is field test. At this stage it will be tested the practicalities and effectiveness test.

Data collection instruments that will be used include the instrument at its initial investigation phase sheet preliminary analysis, questionnaire and observation sheet. While the validity of the instrument to include self evaluation, validation instrument. Practicality instruments that will be used is a student questionnaire, teacher questionnaire and sheet axecution of RPP. Instruments effectiveness through cognitive testing in the form of the final test. Each instrument will be validated first.

CONCLUSION

Based on stages in ploom , expected later this research could produce devices based learning approach to MEAs are valid , practical and effective. So the learning tools will be used as an additional source of learning in schools that can enhance problem solving abilities of learners .

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THE DEVELOPMENT OF MATHEMATICS LEARNING EQUIPMENTS BASED ON PROBLEM BASED LEARNING FOR CLASS VII STUDENT AT JUNIOR HIGH SCHOOL

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Abstract

Problem solving ability of students who met in some school is still low. The cause of the low ability of solving problems of students because the students lack understanding mathematics problems related to real life that surrounds the student, so that the students are less creative in thinking. This is due to the learning equipments that developed of teachers has not been fulfilled to the optimum. One effort that can be done to overcome these problems, mathematics teachers should develop mathematics learning equipments based on problem based learning for class VII student at junior high school that sutisfied validity, practicality, and effectiveness. This research is a development research with Plomp model, that consist of preliminary research, prototyping stage, and assessment phase. In preliminary research, reseacher takes analysis of needs, analysis of curriculum, and analysis of mathematics concepts. In prototyping stage, researcher designs RPP and LKPD based on problem based learning, then do its own evaluation. Assessment phase do practicalities and effectivities test by limited. The data of practically is obtained from RPP activity sheet which has been done, questionnaire practicalities of teachers and students. The data of effectiveness is obtained from students learning outcomes in the form of a final test to seeing students' problem solving skills.

Keyword: *Problem based learning, Problem solving ability.*

INTRODUCTION

Mathematics is basic science now had been growing in rapidly.The development of that is in mathematics among others is the development of material and usefulness of mathematics itself .Math is an apparatus for developed a way reflect [1].The development of way reflect no soul will escape reasoning problem solving.So mathematics is very necessary in daily life and in the face of progress science and technology, because basically learn math not only to do with numerals and its operation , but also element space as the targets who makes mathematics is very close to life .

Mastery mathematics is enough if only held by some alone in a civilization, but all people have to and had to have mastery mathematics that a certain level of.Mastery mathematics in apart from intend to mastery mathematics as the science, but also mastery will skill mathematical necessary in understanding the world around [2].

Based on standards the contents of 2006 also found some competency standard who had been exercising the use of material mathematics in problem solving.Some of them is in competency standard in the class vii the second half of, exactly at matter the set, material a line and angles, and matter a triangle and quadrilateral.This shows that the problem solving mathematical be the main focus in matter that lesson .

The ability problem solving mathematical students low are also evident in junior high school 32, junior high school 15, and junior high schools Angkasa Lanud Padang.Based on observation and interviews with some of the teachers are in school is on the 24-26 August2015 obtained picture that when school tuition given about that is problem solving, so seen a few an indicator of the ability problem solving school tuition invisible.

Problems the ability problem solving mathematical this must be founded a solution to not found school tuition capable problem solving mathematical low.Means that you can do is implement improvement in learning.One determinant the success of learning and success in the achievement of a goal learning mathematics is the device learning.With the device learning good will help the teacher and school tuition to reach the purpose of learning in systematic.

One of the tools of learning required luminance learning is RPP.RPP are one of the tools learning important because by using lesson plans teachers have a guide to do learning process.In addition, lesson plans are prepared with the aim that learning done can run systematic, effective, fun and could make school tuition feel was challenged in followed him.The lesson plans should be arranged by a teacher and really used as a guide to presentation weighting.

In order to keep the good learning, teachers also have to give it a chance school tuition to play an active role in any learning that done.Liveliness and independence learners need to look in any process of learning, or in other words learners of being subject to learn.One of alternatives that can be done teachers so that school tuition can take active roles and state-owned bank mandiri to develop their knowledge is with LKPD.

After presenting matter in a concise manner and systematic, so that school tuition can be easily mengkontruksiinformasi-informasi delivered.After can also be used school tuition to find solve every problem which is in it.In addition, after also provides about diverse so that it can be improve the school tuition to finish various problems, good that deals with daily life and problems that abstract.

Along with she needs LKPD that are amenable to the ability problem solving, then required also a approach or learning model which can be used as the basis of develop LKPD.After will be more optimal if on the basis of one of the models in learning having the objective of to increase the capacity to think school tuition and teaches school tuition how to fix a problem.One of the models in learning that can be used to reach the goal is through the problem based learning or shortened PBL.

PBL is one of learning model suggested in learning activities in curriculum 2013.Learning PBL starts with the provision of problems that are contextual, non routine or open-ended.These problems would be resolution through a series of activities such as find/identify problems, gather the fact, composing hypothesis, investigate, and conclude alternative problem solving.These activities will help those students to work solve the problems in a move that sitematis to achieve mastery the ability mathematical especially the ability problem solving in the soul of school tuition.

Through RPP and LKPD based PBL, teachers can assist and facilitate school tuition in develop the ability thinking including the capacity problem solving.Lesson plans and lkpd characterized by learning model PBL can make school tuition obtain lessons learned meaningful,because the problems served derived of everyday life school tuition.In addition RPP and LKPD based PBL can also increase the ability to communicate, work groups and skill interpersonal school tuition well [4].

Development RPP and LKPD based PBL is limited will be held on class VII junior high school in the first half II. The use of PBL will be held on matter quadrilateral. Development is embodied in the form of research with a title “The Development Of Mathematics Learning Equipments Based On Problem Based Learning For Class VII Student At Junior High School 15”.

Based on the background matter that has been mentioned, so formulation matter to be answered at the end of this research such as 1) how characteristics RPP and LKPD based PBLto matter mathematics the second half of class VII junior high school are valid and practical? 2) how the effectiveness of RPP and LKPD based PBL to matter mathematics the second half of class VII junior high school?As for the purpose to achieved in this research is 1) to know characteristic RPP and LKPD based pbl to matter mathematics the second half of class VII junior high school validand practical.2) to know the effectiveness of RPP and LKPD based PBL to matter mathematics the second half of class VII junior high school.

The ability problem solving mathematical is capability involving a process apply knowledge or proficiency to achieve a solution or settlement from trouble that has been granted.The ability problem solving mathematical shows that there is the ability to understand concepts and mathematical term.

RESEARCH METHODOLOGY

The kind of research will be done is research development (research and development).Model of development are steps.Model of development lesson plans and lkpd to be used in research development this is the kind of plomp.Model plomp consisting of 3 stage, namely phase of earlier investigation (preliminary research), phase development or building prototypes (development or prototyping phase), and phase an (assessment phase) [3].In the first phase or phase of earlier investigation carried out analysis the needs and context (need and context analysis).The second phase or phase building prototypes carried out activities design, the development and evaluation formative (design, development and formative evaluation).Steps evaluation formative started from evaluation own (self-evaluatio), review alchemist (expert review, evaluation one by one (one-to-one evaluation), evaluation group small (small group evalution) and test the field (field test).Next in phase third or phase an (assessment phase) should be conducted evaluation spring sumatif (semi-summative evaluation) of the test results learning .

The trial was done in limited to one junior high school in the that is 15 the junior high schools.Intrumen used to research of this question list interview, a register of checks, sheets of validation, sheets of observation, that test chief.Before use, each an instrument validated by experts.An instrument have valid used in research.Data analyzed research in accordance with the kind of data.Data analyzed by qualitative in a qualitative manner and quantitative data analyzed and it is categorized so that it can be taken in conclusion qualitatively.

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LEARNING GREATEST COMMON FACTOR (GCF) WITH JIGSAW PUZZLESIN CLASS IV

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Abstract

This study aims to determine the use of jigsaw puzzles in helping students to discover the concept of Greatest Common Factor (GCF)by using PMRI approach. The study uses research type of design validation study which consists of three phases;the preparing for the experiment and the preliminary design,the design experiment phases-the design experiment consisting of a pilot experiment and teaching experiment, and the retrospective analysis. What will be discussed in this paper is only the part of preparing for the experiment consisting of preliminary design that is designing Hypothetical Learning Trajectory (HLT) and the pilot experiment. The subject in this study was the fourth grade students of SD N 55 Pagaralam which consists of 6 students with different abilities. There were two students in high ability, two students in middle ability and two students in low ability. This research resulted in learning trajectory that includes a series of learning processby using jigsaw puzzles in four activities. Collecting data in this study were using video, observation, written tests, documentation and notes during the activities. The results of the studyindicatesthatthe role of jigsaw puzzles by using PMRI approach produced a learningtrajectorywhich can help students to understand the concept of Greatest Common Factor (GCF).

***Keywords**: Greatest Common Factor (GCF), Jigsaw Puzzles, PMRI*

INTRODUCTION

Greatest Common Factor (GCF)of some of the numbers area common factor of the greatest among the factors existing federal of two or more numbers (Kershaw, 2014:331). To determine Greatest Common Factor (GCF) of some of the numbers can be carried out by a common factor, the tree and the table division factor(Kerhsaw, 2014:332). In addition to use a common factor, the tree and the table division factor, there are other ways that can be used to determine Greatest Common Factor (GCF)of some of the numbers by using geometry. Koshy (2007), stated that in order to determine Greatest Common Factor (GCF)can use geometry that is using the squares, with the help of "jigsaw puzzles".

In reality, there are many students who have difficulty in understanding the Greatest Common Factor (GCF)material, this can be seen from the results of several studies as the results of research, Isandespa and Suwarjo (2013) stated that during this time the teachers to teach the material Greatest Common Factor (GCF), the way teachers teach material according to the textbook, give examples of questions and then provide exercises. Teachers do not do the teaching by using methods that are less varied and seem boring. As a result , students' motivation grown hard and learning patterns tend to memorize. Also according to Wahyuni (2011) states that during these, teachers teach thematerial in Least Common Multiple (LCM) and Greatest Common Factor (GCF),Direct use of formal modeling,the learning process where students are exposed directly to the issue of formal mathematics.

To overcome difficulties such students, teachers should be able to choose the model , strategy , approach or method appropriate to the learning and engaging students, in order to make the students to be more interested in learning so they are easy to understand the subject matter. This means that teachers should be able to choose learning approach which regardto students real world. One approach which relates to the real world of students is the learning approach that starts the subject matter of the problem, the problem is the using of *PMRI* approach. PMRI is one approach to learning that is applied in Indonesia, which is also known as the Realistic Mathematics Education (RME) to outside Indonesia. *PMRI* refers to the concept Freudenthal in Realistic Mathematics Education (RME). Two important view point of Freudenthalis(1) mathematics must be connected to reality; and (2) mathematics as human activity" (Zulkardi & Putri, 2010).

Putri (2011) explained that PMRI is one approach to learning that will lead students understand math concepts to construct their own through the previous knowledge related to their daily lives , to find itself on the concept, it is expected that student learning becomes meaningful. In finding the concept can be implemented in a context. According toWijaya (2012:21), context does not have to be a real world problem , but can be in the form of games , the use of props, or other situations as long as it is meaningful and can be imagined in the minds of students. Context does not have to be a real-world problem , but can be inthe form of games , the use of props , or other situations as long as it ismeaningful and can be imagined in the minds of students.One of media that can be used to help understand the material the greatest common factor (GCF) isusing the "Jigsaw Puzzles "

Based on the above statements, this study aims to determine the role of Jigsaw Puzzlesin helping students to qdiscover the concept of greatest common factor (GCF) with PMRI approach .

METHOD

This study uses research methodof *design research* which is an appropriate way to answer questions of researchers and achieve the objectives ofthe study. According to Bakker (2004), The main purpose of design research is to develop theories together with teaching materials. In this study will only discuss onecycle is the pilot phase of an experiment consisting of four activities andsubjects in this study were students in fourth grade N 55 Pagaralam whichamounted to 6 people .

RESULTS AND DISCUSSION

Preliminary Design

This phase has resulted in an HLT tested on stage Preliminary Teaching Experiment (cycle 1). HLT designed consists of four activities, each activity includes the kind of activity , the initial thought, the goal to be achieved,a description of the activity and conjecture students' thinking.The fourth activity is a) play puzzles 1 to find the concept of factors; b) play puzzles 2 to find the concept common factors; c) play puzzles 3 to find the concept greatest commonfactor (GCF); d) Solve problem related with Greatest Common Factor (GCF).The following are activities HLT 1 tested at Preliminary Teaching Experiment.

Preliminary teaching Experiment (Cycle 1)

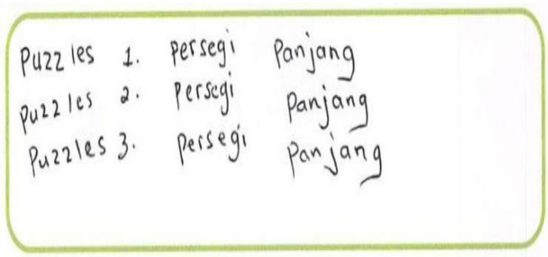
At this stage HLT researchers examined the first small groups of the fourth graders of SD N 55 Pagaralamwhich consists of 6 students with different abilities, there were two students in high ability, two students in midle ability and two students in low ability. The teacher's role is in cycle I.During the lesson the students weredivided into 2 groups, each group consisted of 3 students with differentabilities. The observations along with the analysis of anything happened during the Preliminary Teaching Experiment (Cycle 1) is made and conjectured in thelearning activities are evaluated based on the findings to improve HLT.

Cycle 1 The fourth activity isa) play puzzles 1 to find the concept of factors; b) playpuzzles 2 to find the concept common factors; c) play puzzles 3 to find the conceptgreatest common factor (GCF);d) Solve problem related with Greatest Common Factor (GCF).Prior investigations conduct initial tests to determine the initial ability of students about the FPB material, theinitial results obtained from the pre test. From the three questions given, three students answered correctly and three students answered incorrectly for the first question, for the second question, one student answered correctly and five students answered incorrectly where as for the third question, none of the students answered correctly. Furthermore, the following is the description of the activities during the first cycle .

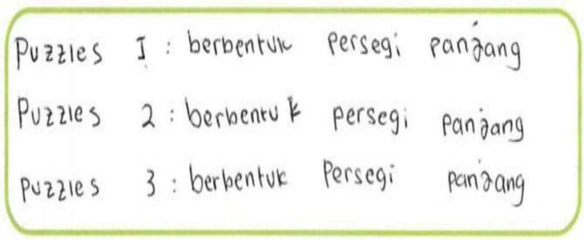
Activity 1 : Play puzzles 1 to find the concept of factors

In this activity each group was asked to prepare three puzzles that have been provided , then after they finished composing the puzzles correctly with the pictures, then the next group was asked to complete the activity of sheet 1 .

In the first questionof the activity each group has been able to determine the shape of the composition of puzzles which they set earlier , as shown in picture 1 and 2 below:



Picture. 1



Picture. 2

While completing the second question in determining the number of squares on eachpuzzle , there was a conversation between the teacher and the secondgroup because initially the second group was incorrect in determining the amount, but after getting referrals they could answer it correctly as shown in the following dialogue:

Dialogue 1 completion of the second question on first activity

Teacher : how many squares are there in the composition of this puzzle?
Student 1 : one ma'am
Teacher : Why just one
Student 1 : it's only onesquare (student pointing image)
Student 2 : no ma’am ,the square is this (pointing to the picture)
Teacher : Why is it
Student 2 : since the square is the same size all are calculated
Teacher : so how many squares are there?
Student : twelve ma'am
Teacher : What about the other puzzles
Student : the total is twelve ma'am

Results answers of each groupis as shown in pictures 3 and 4 below:

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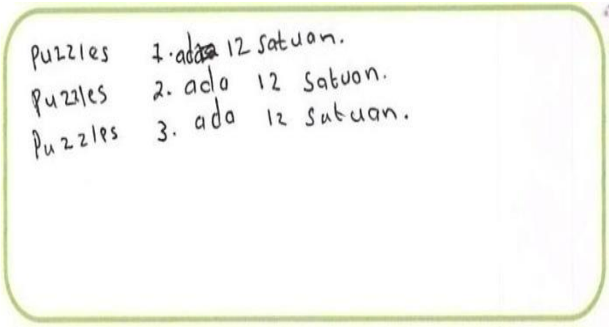
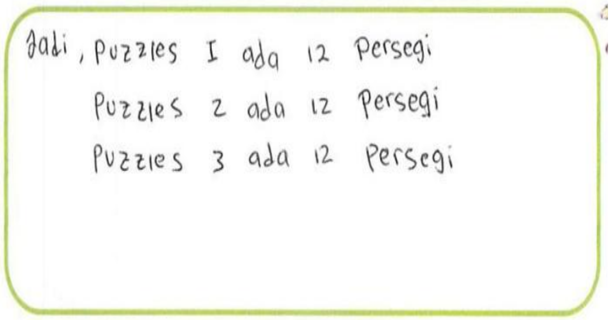
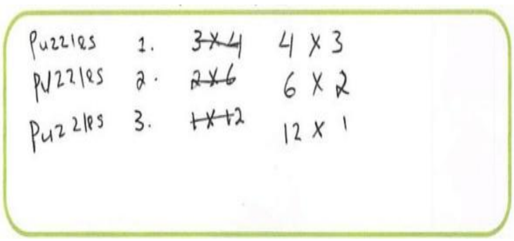
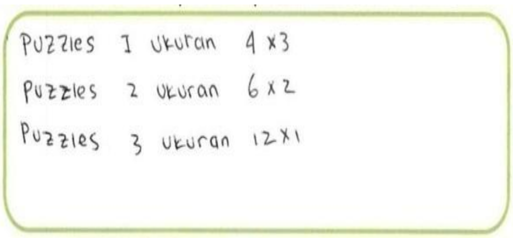




Picture. 3 Picture. 4

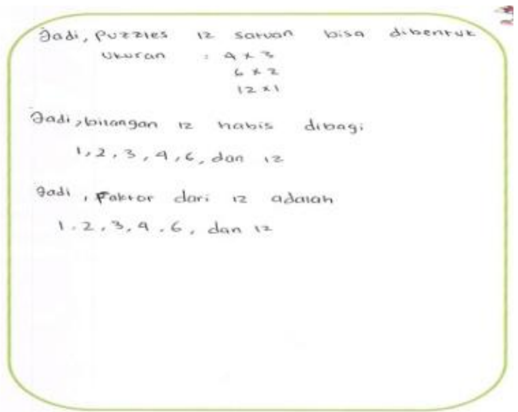
For the third question each of the group could answer the question correctly, as shown in pictures 5 and 6 below:

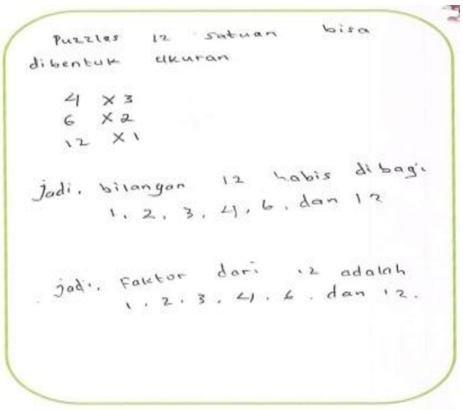




Picture. 5 Picture. 6

Furthermore, for the last question each group was able to determine the conclusion, as shown in pictures 7 and 8 below:





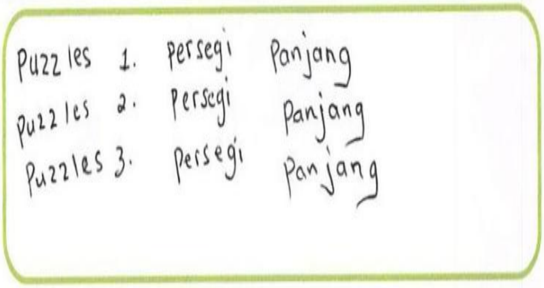
Picture. 7 Picture. 8

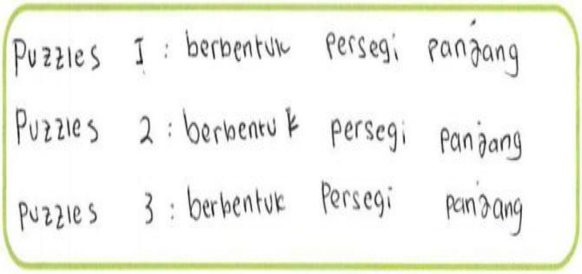
Retrospective Analysis Activity 1

On the one activity in which students play puzzles, then complete the questions in activity 1, at the time of completing this activity, first group answered the questions incorrectly than the second group, as dialogue 1 above where at first, the students identified the number as one square, after getting a referral from their teacher they knew the correct answer.

Activity 2 :Play puzzles 2 to find the concept of common factors

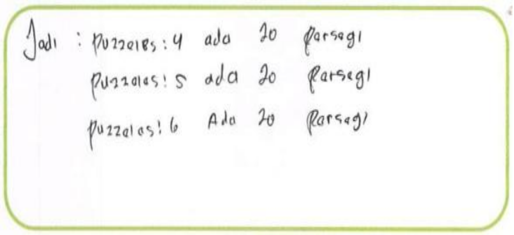
In this activity each group was asked to prepare three puzzles that had been provided , then once finished preparing the puzzles correctly as the image that is cooled , then the next group was asked to complete the activity in sheet 2. In the first case the activityeach groupwas able to determine the shape of the composition of the puzzles which they set earlier, as shown in the pictures 9 and 10 below:

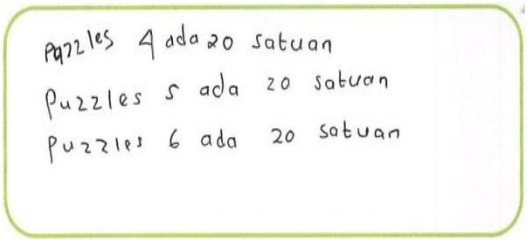




Picture. 9 Picture. 10

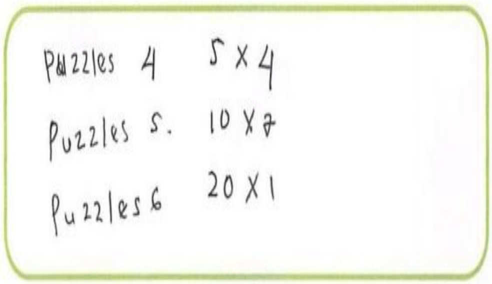
For the second question , each group was able to determine how many square units contained in the puzzles, as shown in pictures 11 and 12 below:

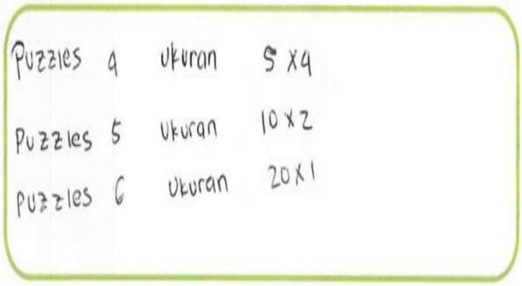




Picture. 11 Picture. 12

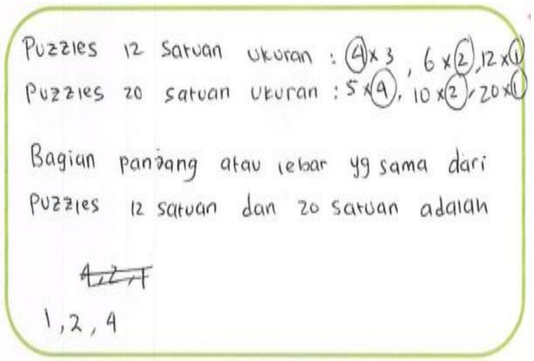
For the third question, each group was also able to mention the size composition of the puzzles which have flats, as shown in pictures 13 and 14 below:



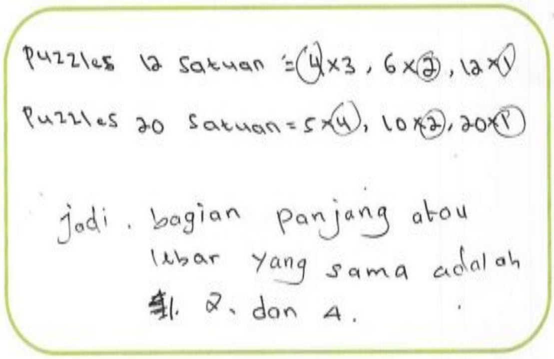


Picture. 13 Picture. 14

In a matter of the fourth question, the students were able to determine which parts are of the same length or width , as shown in pictures 15 and 16 below:

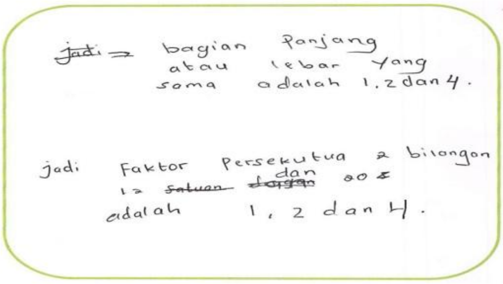


Picture. 15

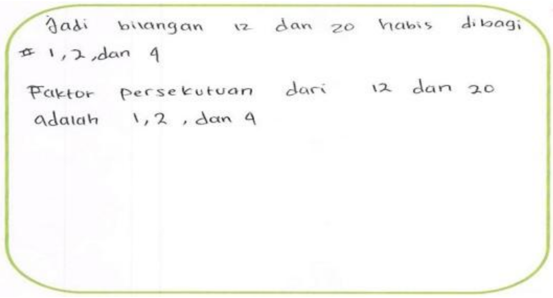


Picture. 16

For the fifth question, respectively each group was able to draw conclusions, as shown in pictures 17 and 18 below:



Picture. 17



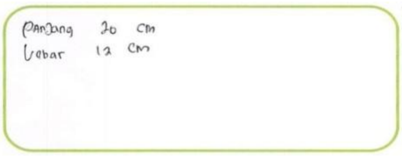
Picture. 18

Retrospective Analysis **Activity 2**

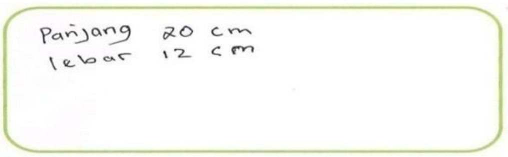
In the second activity respectively students were able to solve problems of the question correctly , although there are some questions that need a guidance from the teacher from the activity, the students were able to draw conclusions.

Activity 3 : Play puzzles 3 to find the concept ofGreatestCommonFactor (GCF)

In this activity each group was asked to draw up puzzles provided , then after the finished composing correctly with pictures cooled , then the next group was asked to complete the activity in sheet 3.In the first case, the They were able to determine the length and width of the puzzles arrangement, as shown in pictures 19 and 20 below:

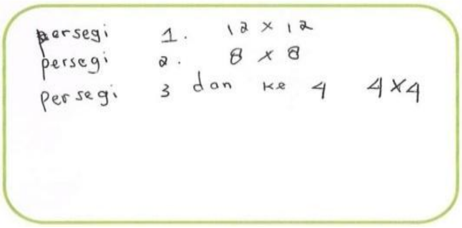


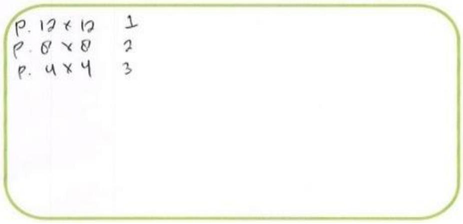
Picture. 19



Picture. 20

For the second quastion,each group was able to determine the size of the squares, the largest to the smallest, as shown in pictures 21 and 22 below:



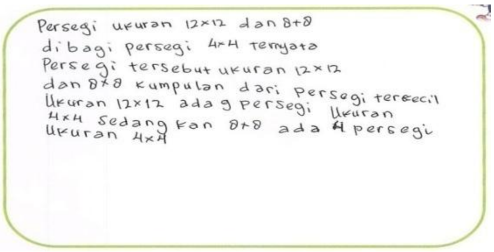


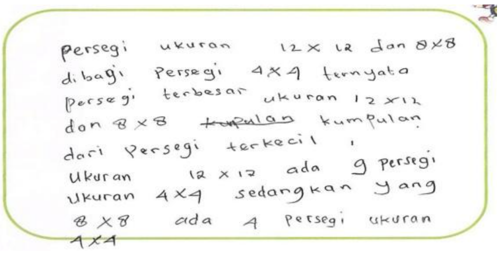
Pictures. 20 Picture. 21

At the completion of the third question, there was a conversation between the teacher and the groups, in which the groupshad different ways of solving the third question. About how they divided the largest square with the smallest square and what happened .

Dialogue 2 in resolving the question into three groups, activity 3
Student : be affixed ma'am
Teacher :how affixed?
Student : a small square placed over a large square then drawn
Teacher : oh yes

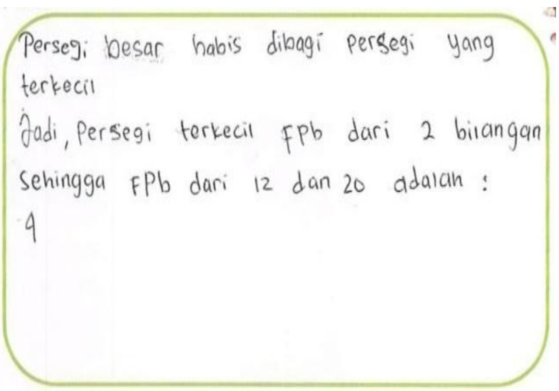
Results answers for each group is shown in pictures 22 and 23below:

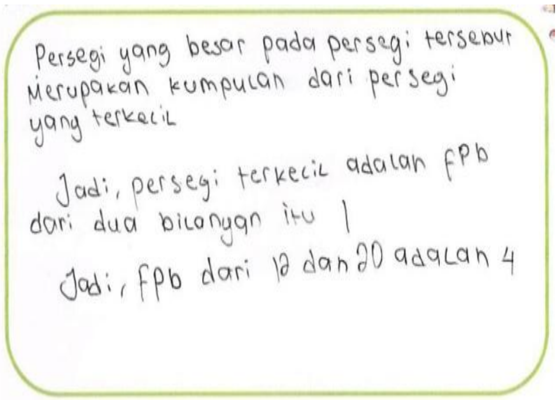




Picture. 22 Picture. 23

For the last question each group was able to draw conclusions as shown in pictures 24 and 25 below:





Picture. 24 Picture. 25

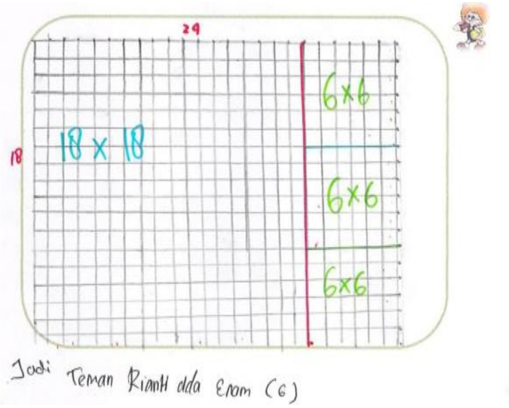
***Retrospective Analysis* Activity 3**

At the time of completing three activities, each was able to resolve the problems, but one group had a different way in solving the question number 3 in activity 3 as illustrated in the dialogue 3 abov . Where one group solved problem number 3 by dividing the large square into a small square, they devoted a small square on a large square and divided it .

Activity 4 : Solve Problem Related with Greatest Common Factor (GCF)

In this activity eachgroup was given 2 problems found in activity 4 , after eachgroupwas giventhe activity sheet, eachgroup began to solve the problems on the activity .

For thefirstquestion each group was able to solve these problems, as shown in pictures 26 below:



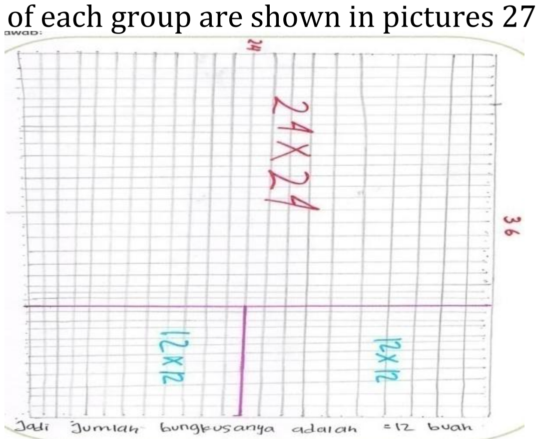
Picture. 26

While for the second question each group was able to solve these problems, there was a conversation between the second group and the teacher, for group 2 in resolving two incomplete in making it's conclusions :

Dialogue3 in resolving problems 2

Teacher *: finished?*
Students *: Already ma'am*
Teacher *: for this problem try to read the question again*
Student *: How many packs can be made by Rosa ? How much each of chocolate and candy on each pack ?*
Teacher *: so how many questions arethere ?*
Student *: there are 2 questionsma'am*
Teacher *: let see your conclusion. Have you completed it yet?*
Students *: oh yes ma'am, less one .*

Results answers of each group are shown in pictures 27 below:



Picture. 27

***Retrospective Analysis* Activity 4**

In the fourth activity, respectively each group was able to resolve the problem the problem lies in the fourth activity. However, there was one group that wasthe second group, which initially did not make complate conclusions, but after receiving a referral from their teacher they could resolve the matter until it's conclusion.

CONCLUSION

Some difficulties faced by students . As in the activities one student mistakenly put the number of the square, but after being directed by the teacher they can fix it. While for the activities, both groups of the students were able to resolve the matter through it's conclusion. In the third activity there wass one group whichhad a different answer they divided a large square into a small square, they rested a small square to the top of a large square and divided it.In the last activity there was one group that solve the problems on their activity incompletelyto the conclusions, but after receiving a referral from their teacher they could resolve the matter until the conclusion.

Based on the results of the research and the discussion, it can be concluded that the use of jigsaw puzzles plays an important role in finding the concept of Greatest Common Factor (GCF).

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Developing Level 4,5,6 of PISA like-problem to Determine Student's Mathematical Communication Skill Of Grade Ten

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Abstract

This study aims to develop a valid and practical level 4,5,6 of PISA-like problem to determine student's mathematical communication skill of Grade Ten. This is a design research with development studies type. This research have two stage that is preliminary and prototyping consisting of self evaluation, expert review, one to one, small group, and field test. But the discussed in this paper is the result expert review, one to one, and validation test on other subject research . Based on expert review, the prototype is valid and Practical.Valid drawn from the results of the assessment validator stating that the matter has been both the content in accordance with the characteristics of PISA and indicators of the ability of mathematical communication.The constructdrawn develop the ability to communicate mathematical ,rich with the concept,in accordance with the level of students of Grade Ten,inviting concept development more ,and language drawn in accordance with EYD, it is not convoluted ,the matter does not contain a double interpretations, limitations questions and answer obviously. It has also been tested to know the quantitative validity, there are 5 question is not valid than 15 questions and the result reability obtained value r_{11} is 0, 80 or 0,80 who show reability is high degrees because $r_{11} \leq 0{,}80$.

Keywords: *Level 4,5,6 of PISA-like problem;DesignResearch;Mathematical Communication Skill*

INTRODUCTION

Organisation for Economic Cooperation and Development (OECD), which is better known as PISA (Programme for International Student Assessment) has organized international studies in the field of mathematics for children aged approximately 15 years (OECD, 2013). Indonesia has participated in the PISA study from 2000 to 2012 as many as five times.

In the PISA mathematical literacy are terms for PISA mathematics is not only seen as a discipline of science, but how students can apply the knowledge in a real-world problem (real world) or their daily lives (OECD, 2013). A person is considered to have literacy levels of mathematics when he was able to analyze, reason, and communicate mathematical knowledge and skills effectively.

Mathematical literacy involves seven basic capabilities one of which is Communication or the ability to communicate the problem (OECD, 2010). Communication is a very important part in mathematics and education of mathematics. Communication is a way to share ideas and clarify understanding. Through communication, the idea can be mirrored, improved, discussed and developed. The communication process also helps build meaning and can publish ideas (Arif, 2009).

In line with the objective of mathematics education as contained in the curriculum SBC, namely that students have the ability to: (1) understand math concepts, explains keterkaitanantarkonsep and apply the concepts or algorithms in a flexible, accurate, efficient, and precise, in problem-solving; (2) using the reasoning in the patterns and nature, perform mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements; (3) solve problems that include the ability to understand the problem, devised a mathematical model, solve the model and interpret the obtained solution; (4) the communication of ideas with symbols, tables, diagrams, or other media to clarify the situation or problem; (5) have an attitude appreciate the usefulness of mathematics in life, are curious, attention, and interest in studying mathematics, as well as a tenacious attitude and confidence in problem solving (MONE, 2006).

In mathematics, communication of mathematics is the student's ability to make connections between the real-world situation into mathematical language in the form of symbols, diagrams, tables, graphs, and other mathematical notation in writing.

There are two important reasons why communication in mathematics learning need is grown among students, namely (1) Mathematics language, meaning that mathematics is not just a tool to think (a tool to aid thinking), tools to find patterns, resolve problems or draw conclusions, but mathematics is also "an invaluable tool for communicating a variety of ideas Clearly, precisely, and succiently". (2) Mathematics learning as a social activity, that is to say as a social activity in mathematics, as a vehicle for interaction among students, as well as a communication tool between teachers and students (Baroody, 1993).

However, the learning device that supports the development of mathematical literacy is lacking, judging from learning outcome assessment instruments (Wardani, 2011). Therefore, while efforts were made to develop students' mathematical literacy skills that give problems PISA, so that students are accustomed to working on the PISA like-problem. As well, it provides learning tools that support the development of mathematical literacy skills to determine the potential of the students, about the extent to which students' mathematical literacy skills, especially his mathematical communication skills.

Accordingly, therefore, researchers are interested in developing the PISA math model to determine the ability of mathematical communications and the potential effect of class X SMA using context OganOganIlir. Then the researchers will conduct development research entitled "**Developing Level 4,5,6 of PISA like-problem to Determine Student's Mathematical Communication Skill of Grade Ten".**

The formulation of the problem posed in this study how is a valid and practicalthe characteristics level 4,5,6 of PISA like-Problem to determine Student's Mathematical Communication Skill Of Grade Ten.

METHOD

The method in this research is the research methods of design research with the type of development studies or research development. This is the kind of development research studies aimed to produce PISA like-problem as enrichment program for students of grade X Senior High School Number 1 TanjungLubuk valid and practical. The study consisted of two phases, which are preliminary or preparatory and prototyping phase (formative evaluation) that includes *self evaluation*, *expert reviews* and *one-to-one* and *small group* and *field test* (Tessmer, 1993, Zulkardi 2002).

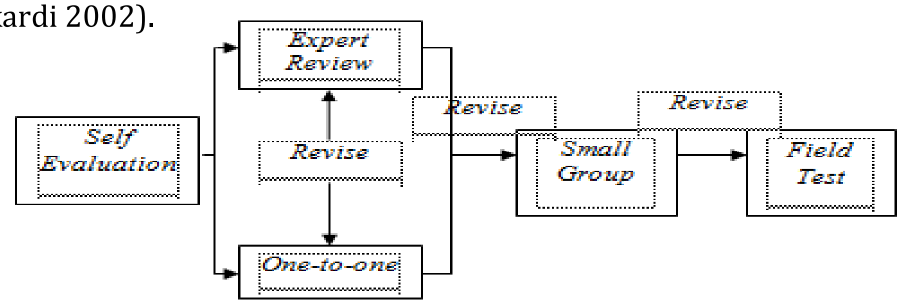

Figure *1*. General sequence of formative evaluation types (Tessmer 1993, Zulkardi 2002)

In the preliminary stage, the researcher conducted an analysis of students, curriculum analysis, and analysis of PISA problems. Furthermore, researcher designs draft of prototype and other instruments of the prototype. The second stage of prototyping begins with self-evaluation stage. Then expert review and one-to-one are conducted simultaneously to test the first prototype. In the expert review phase, the content, construct, and language of the first prototype are validated by using walk-through by experts and peers. The researcher conducted one-to-one test to four students. The results of the expert review and revision of one-to-one produces the second prototype that will be tested at small group. Twelve students were involved in this phase. Students are required to solve the problems and then provide suggestions or comments to know about the practicality of the problems that has been done. The researcher carried out validity and reliability analysis of each items as well. The revision based on the result of small group phase produced the third prototype that will be tested in the field test. In the field test phase, twenty students worked on the third prototype. The techniquesthat we used to collect the data are walk through, documentation, interviews, and tests. But the discussed in this paper is the result expert review, one to one, and validation test on other subject research.

RESULT

In this part will be discussed about the results of the preliminary and prototyping stage of formative evaluation which includes self evaluation, expert review, a one-to-one, small group, and a field test.

At preliminary stage, the researcher conducted preparation such as chose the subject and place of the research. After that, the researcher conducted an analysis of students to determine mathematical ability of the students as the subject of this study. Curriculum analysis and analysis of PISA problems done by the researcher acted as a foundation for developing the problems.

The second stage of this study is prototyping using formative evaluation. The stages are carried out on the formative evaluation consists of three phases. First phase is self evaluation. At this phase, the researcher re-examines and evaluates the draft of the problems that have been designed. Self evaluation phase produces the first prototype of the problems.

The next phase is expert review. Expert review is qualitatively validation of the first prototype based on content, construct and language. The problems were consulted and examined to experts and peers who experienced in mathematics education as a validator. The validators are:

1. Prof. Kaye Stacey, professor of mathematics education at the University of Melbourne, Australia. She is chairman of the Mathematics Expert Group (MEG) for the OECD PISA survey in 2012.
2. Dr. Thien Lei Mee, R & D Specialist (Mathematic Education), Recsam-Penag, Malaysia

Provide comments and suggestions from the expert review :

Table 1.sugesstion / Comments validity of the problem

Validator	Sugesstion / Comments
Dr.Thien Lei Mee	Comments on the whole matter“ You need to the name figure and table , e.g. Figure 1, figure 2, etc. Table 1,table 2 , etc”

	the comment for the problem 2and 3 : the question seems very complicated and difficult to understand. I propose this item replaced by other question in different context.
	To Question 4.1 is no error in the answer key (described in Appendices)
	Komentaruntuksoalsoalnomor 5 : "give 1 statement to indicated" he image must give clear reasons for the showsx+y=5000 ,because the image does not show clearlyx+y=5000
	The Problem number 7 and 8 explanation incomplete
Dr. Kaye Stacey	the problems number 1 and 2 : "this looks like a standart school exercise to me. Some PISA items and like that, but the better one try to present a scenario that makes sense in itself. How does the person know it is a third, for example, I agree with change and relationhips, and formulate.
	Soalnomor 2 : replaced by other question in different context
	The problem of number 3 : "I do not understand what his problem, because it is less clear and difficult too.
	The comment for the problem number 4.1, 4.2, and 4.3 :" that is fine for classrooms purpose, but if you want to derivce scores in certain ways, you need to consider this carefully"
	For the problem number 5 : students may not know how to do the problem using algebra (outside the head whenever they do know about this without algebra)
	The problem of number 7 " the information is not clear"

Based on the results of the second validator comments of 9 units of matter consisting of 15 questions about the number 3 unit consists of 5 questions that are not suitable to be tested as a matter of units 2,3, and 6.In the same time, the researcher conducted one-to-one phase to four students. Because the problems for enrichment program, then the students who involved in this phase have to pass the standard achievement. The procedure in this phase is students solve the PISA like problems and after that the researcher interviewed students to ask for comments and suggestions about the problems. In one-to-one phase, the researcher focuses on the clarity of the problems, the practical aspect of the problems, and students' enthusiasm towards the given problem.The following questions suggested by the validator does not fit tested :

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Table 2. Comment Students At One To One Of Problem

Unit Problem	comments Students *of One To One*		
	Nur'aini	**Nelly Yana**	**Jainabun**
1	No problem	Still a little confused by the explanation the problem	Confused by the words contained in the explanation
2	Confused by because, instead of numbers so confused.	Did not understand the problem	Did not understand the problem
3	Not familiar with the intent matter, because less obvious and harder on penjelsan equation in the problem	Explanation matter not understand	The problem is too complex, too convoluted language bush
4	Understand the purpose of a matter, and there is no problem	The words were too difficult to understand	Do not understand the intent matter, the language is difficult to understand and do not understand the purpose of an explanation about and images
5	Understand the meaning of matter, just after corrected misconceptions in answering questions	Understand the meaning of matter, just after corrected misconceptions in answering questions	Do not know and understand the intent of questions and images
6	o be able to answer 6.1, to about 6.2 and 6.3 do not understand the purpose of equality contained in the question	The problem is too complicated	Do not understand how to do because, because too complicated
7	nitially confused, after being read over and over again just understood	Explanations about the less obvious because it is not t minute.	The problem is less clear, so can not answer

8	No problem, just after the conclusion corrected an error	Do not understand the intent of the question	Because confusing because the explanation is less clear
9	Problem is too hard and could not read the meaning from images	Fooled by the picture so that misinterpretation	ne interpretation of the image, and his comments about too elusive

The next step is carried out by researchers are analyzing the items that exist in the first prototype to test the validity of items and reliability problems. This analysis is done in class X SMA Negeri 1 Tanjung depths amounting to 22 students. Calculation of the validity and reliability questions about done using Microsoft Excel software. Validity test used to measure the validity of a matter. A problem is said to be valid if the question in a matter of being able to express something that is measured by the question. Significance test is done by comparing the t_{hitung} witht $_{tabel.}$

Reliability test is used as a tool to measure a matter which is an indicator of variables or constructs. Reliability testing to determine the consistency of measuring instruments, gauges used if reliable and consistent if the measurement is repeated. Reliability test in this study using Cronbach Alpha (α). A variable is said to be reliable if the value of*Cronbach Alpha*> 0,800.The data and results of calculations about the validity and reliability, as follows:

Table 3.The Results of Validation Test.

Number of Problem	**Correlation coefficient**	t_{hitung}	$t_{tabel.}$	**Explanation**
1.1	0.891	9.2174	2.074	Valid
1.2	0.912	10.4181	2.074	Valid
2	0.323	1.6021	2.074	Tidak Valid
3	0.299	1.4697	2.074	Tidak Valid
4.1	0.679	4.3407	2.074	Valid
4.2	0.466	2.4718	2.074	Valid
4.3	0.861	7.9288	2.074	Valid
5.1	0.451	2.3710	2.074	Valid
5.2	0.515	2.8151	2.074	Valid
6.1	0.343	1.7117	2.074	Tidak Valid
6.2	0.002	0.0084	2.074	Tidak Valid
6.3	0.283	1.3855	2.074	Tidak Valid
7	0.554	3.1230	2.074	Valid

8	0.419	2.1654	2.074	Valid
9	0.666	4.1878	2.074	Valid

Based on the quantitative results of the validity of the test results, there are five questions declared invalid. As for the reliability coefficient of issues Prototype I obtained α value of 0.803 which indicates that the maths model of PISA valid and practical for class X SMA had perfect reliability because the value value α > 0,80.

The revised first prototype based on expert reviews and one-to-one evaluation as described above produce a prototype 2 consisting of 6 units of matter consisting of 10 questions that tested in small group. There are five questions that are not valid according to the validity of quantitative test results are not maintained and tested on a small group stage, as a matter of unit 2 by 1 question, a matter of unit 3 as much as one question, and the question unit 6 as many as three questions. Later that question will be discarded because based on expert reviews and one-to-one evaluation of the fifth question is too difficult to be tested and based on the results of testing the validity of quantitative results are not valid.The following problems are not valid qualitatively and quantitatively :

Unit 2 : Sungai Komering

2.

https://www.google.com/

Gambar diatas merupakan Sungai yang terdapat di daerah Ogan Komering Ilir. Sungai Komering sering meluap jika musim hujan dan kering dimusim kemarau. Jika debit air sungai tersebut adalah$a liter/detik$ pada cuaca normal. Perubahan debit pada cuaca tidak normal adalah sebesar b liter/detik. Tunjukkanlah peningkatan maksimum debit air sungai tersebut pada saat musim hujan !

Unit 3 : Air Pancuran Tugu Biduk Kajangan, Taman Segitiga Mas-Kayuagung

3.

https://www.google.com/

Di taman Segitiga Mas di Kayu agung terdapat sebuah Tugu Biduk Kajangan. Tugu tersebut memiliki 12 pancuran air dan pancuran air tersebut akan dihidupkan setiap jam 4 sore. Salah satu petugas penjaga taman tersebut ingin menghidupkan pancuran air dengan ketinggian seperti tinggi maksimal dari tugu tersebut. Jika $x = 0$ adalah posisi mati pancuran tersebut, maka pola air pancuran yang mengarah ke ketinggian maksimal tugu tersebut diperkirakan memenuhi persamaan $2y – x – 0{,}66 = 0$. Kecepatan angin dan hentakan air saat keluar dari pancuran akan mempengaruhi pergerakan air sehingga kemungkinan lintasan air dapat berubah menjadi $y – 0{,}475x – 0{,}35 = 0$. Pada kecepatan berapakah lintasan air akan mencapai tinggi maksimal dari tugu tersebut?

Unit 6 :JumlahPendudukKabupatenOganKomeringIlir

6. **Tabel 1.1. Jumlah Penduduk Kabupaten Ogan Komering Ilir Berdasarkan Kecamatan Tahun 2005-2010**

Kecamatan	2005	2006	2007	2008	2009	2010
Kayuagung	54,594	55,285	56,482	57,285	58,200	62,694
S.P Padang	40,178	40,687	41,118	42,159	42,832	41,709
Tanjung Lubuk	34,586	33,561	34,200	34,775	35,330	32,296
Teluk Gelam	18,050	19,742	20,370	20,456	20,783	21,268
Jejawi	37,893	38,373	38,850	39,761	40,396	38,098
Pampangan	29,231	26,956	27,426	27,931	28,377	27,758
Pangkalan Lampan	21,909	24,832	25,236	25,730	26,141	26,033
Pedamaran	34,503	36,303	36,960	37,616	38,217	40,114
Pandamaran Timur	19,615	18,499	18,972	19,168	19,474	20,110
Lempuing	66,710	61,433	62,356	63,654	64,670	70,642
Lempuing Jaya	50,941	57,707	58,623	59,794	60,749	59,785
Mesuji	38,128	34,161	35,013	35,397	35,962	38,870
Mesuji Makmur	30,814	42,097	42,840	43,619	44,316	51,456
Mesuji Raya	36,665	30,685	46,170	31,795	47,214	34,334
Air Sugihan	31,986	32,391	32,964	33,563	31,462	32,180
Tulung Salapan	44,183	44,743	45,481	46,362	32,303	40,683
Cengal	29,514	29,887	30,624	30,968	32,303	42,778
Sungai Menang	44,290	44,850	31,611	46,472	32,303	46,567
Jumlah	**663.790**	**672.192**	**685.296**	**696.505**	**707.627**	**727,376**

Tabel diatas merupakan informasi jumlah penduduk Kabupaten Ogan Komering Ilir yang di peroleh dari Buku Putih Sanitasi (BPS) Kabupaten Ogan Komering Ilir.Jumlah penduduk Kabupaten Ogan Komering Ilir setiap tahunnya terus meningkat dengan taraf laju pertumbuhan diperkirakan 2 % per tahun.

Pertanyaan1 :
Berapakah perkiraan jumlah penduduk kabupaten Ogan Komering Ilir pada tahun 2020?

Pertanyaan 2:
Carilah model pertumbuhan atau penurunan eksponensial $y = ae^{bt}$ atau $y = ae^{-bt}$ untuk wilayah Tanjung Lubuk dan Kayu agung untuk rentang tahun 2009-2010, dengan memisalkan t= 10 untuk tahun 2009 dan t=20 untuk tahun 2010. Gunakan model ini untuk memprediksi jumlah penduduk pada wilayah kecamatan Tanjung Lubuk dan Kayuagung pada tahun berikutnya.

Pertanyaan 3:
Kita dapat melihat bahwa laju pertumbuhan penduduk di kecamatan Tanjung Lubuk berbeda dengan di kecamatan kayu agung. Konstanta manakah dalam persamaan $y = ae^{bt}$ yang memberikan laju pertumbuhan penduduk? Apakah hubungan antara laju pertumbuhan penduduk yang berbeda dengan besar konstanta tersebut?

DISCUSSION

This study has resulted the level 4,5,6 of PISA like problems to determine student's mathematical communication skill of grade ten. Based on expert review, the prototype is valid and Practical.Valid drawn from the results of the assessment validator stating that the matter has been both the content in accordance with the characteristics of PISA and indicators of the ability of mathematical communication.The construct drawn develop the ability to communicate mathematical ,rich with the concept,in accordance with the level of students of Grade Ten,inviting concept development more ,and language drawn in accordance with EYD, it is not convoluted ,the matter does not contain a double interpretations, limitations questions and answer obviously. It has also been tested to know the quantitative validity, there are 5 question is not valid than 15 questions and the result reability obtained value r_{11} is 0, 80 or 0,80 who show reability is high degrees because $r_{11} \leq 0{,}80$.

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DEFINE PHASE DEVELOPMENT OF TEACHING MATERIALS BASED REALISRTIC MATHEMATICS EDUCATION ON THE MATERIAL PERMUTATIONS AND COMBINATIONS

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Abstract

Research on the define phase aims to analyze the problem, needs and characteristics of students in developing teaching materials on the material permutations and combinations for class XI SMA. The development method used to follow the model of the 4-D, which comprises four steps to define, design, develop and disseminate. This research is focused on the first phase of which define. Data collection was done in SMA Pertiwi 1 Padang. Techniques of data collection is done through the analysis of the syllabus, analysis of the sources used books relatingto the material permutations and combinations, as well as interviews with teachers and students of class XI SMA Pertiwi 1 Padang. The analysis result showed that students in need of teaching materials based Realistics Mathematics Education on the material permutations and combinations. The conclusions of the study on the define phase of this is that during this timethe students have difficulty in distinguishing between permutations and combinations, and students will also need instructional materials in accordance with the characteristics of students, for this study will be continued at the stage of design based Realistic Mathematics Education on the material permutations and combination.

Keywords : Teaching Materials, Realistic Mathematics Education, Permutations and Combinations

INTRODUCTION

Learning math is an attempt or effort of teachers in constructing mathematical concepts and apply it back in real life. Nikson in Muliyardi (2002 : 3) argues that " Learning mathematics is an effort to help students construct concepts or the principles of mathematics on their own through a process of internalization that principle or concept was awakened " .

In the process of learning mathematics , teachers should have to be able to create an atmosphere that is fun, not boring ,and pay attention to the student desires . Therefore , to support the learning process fun , necessary teaching materials appropriate to the characteristics of the students .

Based on observations by the author , teachers have been implementing the learning process well , teachers also have to implement a variety of teaching methods so that students interested in learning so that teachers expect the purpose of learning achieved. But the reality , there are many grades of students who are not in accordance with the teacher's expectations . At the time of observation authors also conducted interviews with teachers , and the conclusion that the authors get, that students rarely repeat the lesson at home , except when going to repeat daily, source books in the library are also being used by students well .

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Meanwhile, the author also conducted interviews with some of the students, conclusion that writers get, that students feel bored reading books in the library package that only contains the symbols and formulas, other than that the book is also difficult to understand. Based on the phenomenon that the author found in the field, the authors conducted research on the development of teaching materials based on realistic mathematics accordance with the characteristics of students. In this study, the authors develop teaching materials on the material permutations and combinations, because based on observations and interviews with teachers and students the authors obtained information that students find it difficult when faced with a problem, they do not understand how their resolution, whether by permutation or combination.

RESEARCH METHODOLOGY

This type of research is the development of research. Teaching materials developed in this research is the mathematical teaching materials based on the material RME approach permutations and combinations. The observations were made in class XI IPA derived from SMA Pertiwi 1 Padang. Research development of teaching materials based on RME's mathematical development model 4-D suggested by Thiagarajan, Semmel tahun 1974 in Trianto (2012:93-96), that is define, design, develop dan disseminate.

In this study, carried out only at the first stage define phase. Steps performed on the define phase are:

1. Front-End analysis
   Analysis carried out by the front end of observations and interviews with teachers and students to find problems and solutions to overcome these problems.
2. Learner analysis
   Analysis of the students is done by conducting interviews with teachers or related parties to determine the characteristics of students as students' backgrounds in terms of age and academic ability of students. The results of this analysis can be used as illustration to prepare products such as those in grammar and difficulty of the questions that correspond to the characteristics of the student.
3. Task analysis
   The task analysis is a set of procedures to determine the contents of the learning unit. This analysis is done by detailing the contents of teaching materials in the form of an outline that includes basic competencies, indicators and formulation of learning objectives.

RESULT OF RESEARCH

Results of research on the define phase are:

1. Front-end analysis
   Analysis aims to bring the front end and set a basic problem in mathematical research sehunga mathematics teaching materials need to be developed based on the material RME permutations and combinations. Based on the observation that the author did on January 18, 2016, revealed that of all the learning material in class XI first half, permutations and combinations of material is one material that is difficult to understand by most students. Students are difficult to distinguish the application of permutations and combinations when faced with a problem. This lack of attention of students in the learning process of mathematics as well as the difficulty of students to

understand the material permutations and combinations of the constraints faced by teachers in achieving the learning objectives. Therefore, it is necessary to develop a teaching material based on the material RME permutations and combinations that match the characteristics of the students.

2. Learner analysis

   Based on the analysis of students through an interview with an employee of administration in Pertiwi 1 SMA Padang, it was revealed that a class XI student generally has between 16-17 years of age. The results of this analysis obtained a description to set up mathematics teaching materials based on the material RME permutations and combinations for class XI student of high school, such as the use of grammar and level kasulitan questions tailored to the age characteristics of students in high school education.

3. Task analysis

   The task analysis is done by detailing the contents of teaching materials in the form of an outline that includes basic competencies, indicators and learning objectives.

   Basic competencies :
   1.4 Using the product rule, permutations and combinations in problem solving
   Indicator
   1. Defining and using permutation permutation in problem solving.
   2. Define combinations and uses a combination in problem solving.
   3. Working with the matter both with regard to the material on a charging rules, rules (rules) as addition, multiplication rule, factorial notation, permutations, combinations, and binom Newton.

   Learning objectives :
   1. Students can define and use permutations permutations in problem solving.
   2. Students can define combinations and uses a combination in problem solving.
   3. Students are able to work on the problems with both with regard to the material on a charging rules, rules (rules) as addition, multiplication rule, factorial notation, permutations, combinations, and binom Newton.

CONCLUSION

From the analysis on the define phase was concluded that the textbooks used in schools to make students do not understand the subject matter well, because that's required instructional materials in accordance with the characteristics of the students.

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Implementation Cooperative Pair Check the Enhancement Activities Learning Mathematics in Class XII of Automotive Engineering Vehicle Light (TOKR) SMK Citra Utama Padang

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Abstract

Implementation of cooperative learning is one alternative that can be used in the process of learning mathematics. Cooperative learning has the advantage of motivating students in learning groups, in terms of awards and cooperative group learning activities within the group so that cooperative learning may increase. In cooperative learning Pair Check these students are divided into small groups consisting of two people in one group, where students in the group to think about individual questions provided by the teacher, then they discussed with their partner about the questions given by the teacher, and the teacher asked the group to present the couple in front of class. This study aims to look at how to increase students' learning activities to implement the type cooperative learning Pair Check. This research is a classroom action research. The subject of this research is a class XII student of Automotive Engineering Vehicle Light (TOKR) SMK Padang Citra Utama of 20 people. The results of this study indicate that the adoption of Cooperative Pair mode Check the math learning can improve students' learning activities during the learning process in Class XII students of Automotive Engineering Vehicle Light (TOKR) SMK Padang Citra Utama.
Keywords : Cooperative, pair type check , the learning activities

INTRODUCTION

Education is changing attitudes and code of conduct person or group of people in terms of human mature through teaching and training efforts. Education is a necessity that must be met in the process of life. Progress of a nation is influenced by the quality of education of the nation itself because education can print high quality human resources. Education is meant here is not to be informal, but rather includes the formal learning process involving teachers and students. Improving the quality of education is reflected by student achievement. While the success or student achievement is influenced by the quality of a good education. Because the quality of a good education will lead students to improve learning achievement better.

Mathematics is a science that was instrumental in the development of science because in mathematics there are concepts of other sciences such as engineering, economics, and social. Therefore, the quality of mathematics education must be increased from the outset. It is useful to improve the quality of human resources that have the ability to master and develop science and technology .

Given the importance of the role of mathematics, the government has tried to improve the quality of mathematics education by implementing an increase in the learning process, curriculum improvement, as well as equip school facilities and infrastructure. But in fact, the efforts that have been made are not yet provide maximum results.

Based on the observation that researchers do students feel in school look, the school just to get a diploma only because the students rarely get into the classroom, into the classroom even if these students must be picked up their place of rest. And sometimes teachers and students should romp to be having students learn . At the time of the lessons students often ask permission and unplug it from the school , the teachers picket berisiniatif to lock the fence and sometimes they have to rest of the class.

In the learning process of students is only serious in pay attention teacher explains the material, and even then most of 10 minutes and immediately provide practice and training in working groups of students always do, and when they are told to do on their own, then these students will be noisy.

For the implementation of cooperative learning is one alternative that can be used in mathematics . Cooperative learning has the advantage of motivating students in learning groups, in terms of the group awards and teamwork. One cooperative learning that can improve is the type cooperative learning group Pair Check.

In lessons Pair Check these students are divided into small groups consisting of two people in one group, where students in the group to think about individual questions given by the teacher, and then they discuss with their partner about the questions given by the teacher, and the teacher asked group to present to the couple in front of the class. So that students can find solutions to problems and help each other understand mathematical concepts actively .

THEORITICAL REVIEW

1) TEACHING MATH

The learning process is essentially a process of communication between teachers and students resulting in a change in behavior better . [12] suggests "Learning is a process attempts person to obtain a new behavior changes as a whole as a result of his own experience in interaction with the environment". These changes include the attitudes, skills, knowledge, and as a result of his own experience in interacting with the environment

Learning activities carried out by the students, but in learning are teaching activities carried out by the teacher. Teaching is an attempt by teachers to create learning conditions for students . In the process of learning need to be developed to the students , so that students can understand how the so-called learning in mathematics. Nikson in [8] says that: Learning math is an effort to help students construct concepts or principles of mathematics on their own through a process of internalization that principle or concept was awake again.

Active role of students is very desirable in mathematics. Learning mathematics requires higher reasoning processes in linking symbols and apply the concepts that exist in the real situation. For that a teacher plays an important role. Teachers not only have to master the teaching materials, but also have to master the methods and approaches appropriate learning. One model of learning that is appropriate and in line with the above explanation is the implementation of cooperative learning.

2) COOPERATIVE LEARNING

Cooperative Learning is concerned grouping technique in which students work focused on learning objectives in a tiny group that generally consist of 2 to 5 people. As described [4] that "Cooperative learning is composed of a small group of students who work as a team to complete a task, or something to do achieve common goals more". In addition [7] also revealed the "Cooperative learning is a teaching and learning activities in small groups, students learn and work together to get the experience of individuals and groups " .

On Cooperative Learning students will learn in a group to study the matter and will get the experience of individuals and groups. Each group usually consists of student abilities and different genders. In Cooperative learning is the teacher acts as a facilitator.

Five essential elements that must be applied in cooperative teaching as suggested [1] that "In order for learning to achieve maximum results, there are five important elements that must be applied in Cooperative Learning, namely :

a. Positive interdependence: which working groups were set such that each of its members have different tasks but interrelated.
b . Individual responsibility: This element is a direct result of the first element, where students will have the obligation to provide information obtained to the other group members.
c. Face to face : cooperative learning, interaction not only take place in a group of co-operation, but also with other groups. The ideas of the group will be discussed with other groups and students will further refine the information obtained .
d . Communication between members: this element request maps that the students be equipped with a wide range of communication skills. Because not all students have skills in listening and speaking, students will The work that goes something other than the material being discussed, namely how to communicate among members of a group and with other groups .
e . Evaluation of group process: this evaluation was held to further streamline the cooperation that has taken place. Evaluations are held whenever there is no group work, but held over a period of time after several times learning with cooperative learning.

Cooperative Learning has six stages / steps. such measures as shown in the following table:

Fase	Teacher Behavior
Fase 1 Outlines the objectives and motivate students	Teachers convey all the goals to be achieved in learning and motivate students to learn
Fase 2 Presenting information	Teachers present information to students by way of demonstration or reading material
Fase 3 Organize students into groups to learn	Teachers explain to students how to form study groups and help each group to make the transition efficiently
Fase 4 Guiding the group work and study	Teachers guide the group to learn by the time they do their work

Fase 5 Evaluation	Teachers evaluate learning outcomes of the material that has been learned or group presented its work
Fase 6 giving awards	Teachers looking for ways to appreciate the effort and the learning outcomes of individuals and groups

In cooperative learning, class prepared on small groups that can be created on 2-5 students. Grouping students in cooperative learning is a heterogeneous grouping. In this study the formation of groups is based on academic ability by using the value of final exams first .

3) COOPERATIVE LEARNING TYPE CHECK PAIR

One of the tasks of teachers in cooperative learning is to teach cooperation or work together to complete the task so that the person knows how to work cooperatively. In group learning a lot of students who have difficulty in sharing time and materials. To facilitate the distribution of learning time and materials in this group, we encourage members of his group shall be composed of two or pairs.

Being a regulator against another student, speak beyond the learning context, and do their own work groups are examples of the inability of students in the sharing of time and materials. To overcome this developed an approach in the form of Cooperative Learning type Pair check or checks in pairs, where students made up of two people in a working group and check interchangeably .

Pair check or checks in pairs involves eight steps recommended by Spenser Kagan in [6], namely:

Step 1 : Working in pairs. Each group consisted of two students, one student working on an activity sheet or problem, while the other students help or coaching.

Step 2 : Trainer check. Students who become trainers check work partner. If the coach and his partner can not agree on an answer or idea, they should inquire of other couples.

Step 3 : Coach praises. If the partner agrees then the coach to give a compliment.

Step 4-6 : Exchanging roles. The whole partners switch roles and repeat step 1

Step 7 : Couple checking. The entire team mate back together and compare answers.

Step 8 : The team expressed the joy of togetherness. When fully agree with those answers, the team members perform a handshake or doing something else as a sign of togetherness.

These eight steps will be applied in the conduct of research. In the implementation of this activity the teacher to monitor the work of small groups to make sure the activities take place seamlessly. If in the group of students I do exercises while student 2 does not work then the teacher should explain the type of Cooperative Learning Pair check until all students can understand their duties within the group. When all the students have learned and can apply Cooperative Learning type Check Pair this with the next good teacher to evaluate learning outcomes by written test and an oral test .

Check Pair mode has advantages and disadvantages presented [1], namely:

a) The surplus
   1. Increasing the participation of members of the group
   2. Suitable for simple task
   3. More chances for the contribution of each member of the group

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4. Interaction easier
5. It is easier and faster

b) shortcomings
1. Many groups report to and driven
2. Fewer idea appears
3. In case of dispute there is no mediator

Businesses that can do the teachers to address weaknesses in groups of twos are the teacher should explain to the students that the study group had to be sporty in order to avoid a dispute at the time of the study group and each student should be able to pull out all the ideas without any sense of shame that any the students submitted ideas that could make this pair of group learning better. In addition a teacher should be able to overcome the existing weaknesses in how to monitor and guide students in doing exercise by walking around at each table pair. If there are constraints on some groups, the researcher explains more about the type of learning Pair Check.

DESCRIPTION DATA RESULTS

This research was conducted at SMK Citra Utama Padang with the subject of this study Automotive Engineering students of class XII Light Vehicle consists of 20 people. The data collection conducted research in the learning process with the application of the type cooperative Pair check. Cycle research conducted by two cycles, each cycle consisting of three meetings and one-time test .

At study entry dated January 21, 2014, the authors see the response of students is very less because the time to study mathematics at 10:30 am (after the break), on first meeting, student activities were first in taking into account the teacher's explanation of the subject matter only reached 30%, the second meeting 60%, and the third meeting already noticeable increase to 100% due to the students who attended cuman 1. In the second student activity that is discussed within the group to resolve the issue and reversed roles 20%, 30%, while the second meeting of the third meeting of 0% due to the students who attended only one people.

In the third student activity is to give feedback, opinions, and questions to other groups said to be not very good because every meeting students do not want to linger in the learning process. Activities of students in rechecking the results of the discussion quite well because after the students discussing their always ask the teacher how the results of their discussion except the third meeting, during the first meeting 25%, 40% the second meeting.

Activities students presented the group's work is said to be less because of that want to show their work only student that's it. Activities of students in making inferences reasonably well from 45% increased to 90% at the meeting to two for each learning students are required to make conclusions or notes. Activities students do chores at home that the teacher only some students who want to do task because almost all students leave school records. As for the results obtained for the first cycle:

Table 1 : Observations of Student Activities in Cycle I

No	Activities Students	Observations Meeting Score and %		
		I	II	II
1	Listen to the explanation of the teacher .	(6) 30%	(12) 60%	(1) 100%
2	Students discuss in groups to solve problems and exchange roles	(4) 20%	(6) 30%	(0) 0%
3	Students give feedback, opinions, and questions to other groups	(-) -	(-) -	(-) -
4	Students rechecking the results of discussions	(5) 25%	(8) 40%	(-)
5	Students presented the results of the working group	(2) 10%	(2) 10%	(-) -
6	Students make inferences material that has been studied	(9) 45%	(18) 90%	(1) 100%
7	Students work on homework given by the teacher	(-) -	(4) 20%	(1) 100%

After the implementation of the first cycle of three meeting then carried reflection. Results of reflection observer researcher with the research data in the first cycle related to student learning activities to note as a consequence of the provision of action in the first cycle is as follows :

a. Activities of students who pay attention to the teacher's explanation has been increased from the first meeting to the third meeting, but still in the category enough although the third meeting of 100 % for the 1% .
b. Activities students discuss in groups to solve problems and exchange roles should be improved and need to be motivated so that students want to discuss in groups to solve problems and exchange roles.
c. Activities of students giving feedback, opinions, and questions to the other group was given to motivation so that students want to provide feedback, opinions, and questions to other groups.
d. Activities rechecking the results of the discussion has increased but still dikatogorikan lacking and needs to be increased again.
e. Activities students presented the results of the working group should be given motivation so that students want to present their work and needs to be increased again.

f. Activities of students in making inferences should be increased again although these activities are categorized quite well with little to no emphasis in this activity.
g. Activities of students in doing the task need to be improved because the views of any student meeting difficult task because very few who want to carry a notebook to go home so that students' difficulties to face the next lesson.

From the result of reflection above, it is known that the low activity Listen to the explanation of the teacher. Students discuss in groups to solve problems and exchange roles. Students give feedback, opinions, and questions to other groups. Students rechecking the results of the discussion. Students presented the group's work. Students make inferences materials that have been studied. Students homework assigned by the teacher, the main problems that need to be resolved. Factors that predicted for the low activities include: lack of student interest to the lesson, especially math.

Based on the result of reflection, the number of students who participate in these activities both at the meeting of the first, second and third are still not in accordance with the number of students who are expected to participate so that the necessary follow-up for the next cycle.

The observation of student activity during the learning that takes place on the second cycle. The first meeting in this second cycle was held on February 4, 2014, shows that the students have started their activity increased by categorized as enough. Researchers looked at students already actively pay attention to the teacher's explanation and asked the teacher, this activity increased by 80% and 60% for Activities Students discuss in groups to solve problems and exchange an increasing role but still categorized enough. Activities of students giving feedback, opinions, and questions to the others is still no improvement because they are afraid of being laughed friends if any questions or feedback, student activity rechecking the results of the discussion also increased to 80%. Activities students make inferences increased well, students have started to conclude conclusion although the subject matter still need the guidance of a teacher.

Table 2 : Observations of Student Activities in Cycle II

No	Activities Students	Observations Meeting Score and %		
		I	II	III
1	Listen to the explanation of the teacher .	(10) 50%	(10) 66,7%	(16) 80%
2	Students discuss in groups to solve problems and exchange roles	(4) 20%	(6) 40%	(12) 60%
3	Students give feedback, opinions, and questions to other groups	(-) -	(-) -	(-) -
4	Students rechecking the results of discussions	(10) 50%	(15) 100%	(16) 80%
5	Students presented the results of the working group	(2) 10%	(2) 13,3%	(4) 20

6	Students make inferences material that has been studied	(10) 50%	(15) 100%	(16) 80%
7	Students work on homework given by the teacher	(3) 15%	(5) 333%	(8) 40%

The implementation of cooperative learning model Pair this check has been carried out in class XII Automotive Engineering Vehicle Light (TOKR) SMK Citra Utama Padang. The result of the application of learning is evident from the increased activity and results of students' mathematics learning.

The implementation of cooperative learning model has a positive impact on the improvement of student learning activities, although sometimes the teacher asked the teacher on duty to supervise the activities of students, especially after the break and the teacher worked extra in order to persuade the students to want to learn and give rewards to students so that they want to learn.

Overall activity is done by many students in the class either by the student cognitive ability is high, medium or low. It is characterized by a number of students who participated exceed 70% of the number of students in the classroom. Students are capable of medium and high cognitive generally explains the material that is not understood by his friends that low cognitive ability without being harmed. While the students are capable of low kogintif can learn in an atmosphere that is fun because a lot of friends who help and motivate.

Nurhadi et al (in Made Wena, 2009: 191) says that the face to face interaction requires students in each group face to face so that they can have a dialogue, not only with teachers, but also with fellow students.

Researcher as teacher implementers and observer agreed to stop action on the second cycle of the study through this. This is because all the indicators of success defined for each activity indicator has been met.

CONCLUSION

Implementation Cooperative Pair mode Check the math learning can improve students' mathematics learning activities during the learning process in Class XII students of Automotive Engineering Vehicle Light (TOKR) SMK Citra Utama Padang.

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DEVELOPING STUDENT LEARNING MATERIALS ON THE MULTIPLICATION FRACTIONS FOR GRADE FIVE WITH REALISTIC MATHEMATICS EDUCATION

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Abstract

Lortie-Forgues, Tian and Siegel (2015) suggests that students' understanding of the fractions was very important in the study of mathematics further and was also used in many professions, but according to Lortie-Forgues, Tian and Siegle (2015) and MA (1999), many students had great difficulty in understanding it. Furthermore, according to Ma (1999), the difficulty was not only the difficulties experienced by students in learning fractions, but also the difficulties experienced teachers to teach the concept of fraction.It was felt by teacher at one of the private elementary school in Yogyakarta, especially in teaching multiplication on fraction.The goals of this study were (1) to build a context that can be used to introduce the meaning of multiplication of two fractions and establish procedures multiply two fractions, (2) to describe the learning path by using the context, and (3) to describe the development of learning outcomes achieved by students. There were two contexts used by the researchers in this study that werebuyingthe ribbon and giving oranges. Lesson plans created by the researcher were for students of grade five. This type of research used by the researcher in this study was the design research developed by Gravemeijer and Cobb. According Gravemeijer and Cobb (in Akker, Gravemeijer, McKeney, and Nieveen, 2006) there were three phases in the research development, namely (1) the preparation of thedesign, (2) testing the design, and (3) the retrospective analysis.

Key Words:*the multiplication of fractions, realistic mathematics education (RME), and design research*.

INTRODUCTION

In 2013 and 2014, the researcher developed some context and sequence of learning that could be used to teach the fractional multiplication in gradefiveof the elementary school. From the experience of two years, the researcher wanted to develop other contexts that would be used to teach the multiplication of the fraction in gradefiveof the elementary school. In this year, the researcher had the opportunity to develop and provide contextsabout buyingthe ribbon, and giving oranges. The researcher also got the opportunity to pilot the lesson plan in one class on grade five in a private elementary school in Yogyakarta.

Lortie-Forgues, Tian and Siegel (2015) suggests that students' understanding of the fractions was very important in the study of mathematics further and was also used in many professions, but according to Lortie-Forgues, Tian and Siegle (2015) and MA (1999), many students had great difficulty in understanding it. Furthermore, according to Ma (1999), the difficulty was not only the difficulties experienced by students in learning fractions, but also the difficulties experienced teachers to teach the concept of fraction. There were several studies that have been done related to fractions which explains why fractions into one material that is difficult to understand by students, namely:

1. According to Lamon (2001, in Ayunika, 2012), the development of understanding of the meaning of fractions in the teaching-learning process was a complex process because the concept of fraction had a number of interpretations, namely (1) fraction as a part of the

whole, (2) fraction as the result of a measurement, (3) fraction as an operator, (4) fraction as a quotient, and (5) fraction as a ratio.
2. According to Ross and Case (1999 in Shanty, 2011), on the process of learning fractions, teachers often emphasize on how to do the operation procedure than on the meaning of the operation.
3. StafylidoudanVosniadou (2004 in in Shanty, 2011) states that one of the reasons why the idea of mathematical fractions were systematically misinterpreted by students was an inconsistency with the principles of arithmetic used in operations involving natural numbers. For example in the operation of multiplication of natural numbers, if the two natural numbers multiplied, then the multiplicative result was a natural number greater than or equal to two natural numbers are multiplied. It was not always the case if the two fractions multiplied.
4. AccordingStreefland (1991), in many textbooks the instruction of fractions were characterized by:
   a. Towards the concept of fraction.
   b. There were not meaningful contexts both as sources and domains for the application of fractions.
   c. The isolated use of models and patterns, which never extends to serve the process of algorithmization or mathematization.
   d. There were not connections with mathematically domains, such as decimal fractions, ratios, scale, and percentages (Vergnaud, 1981).
   e. Towards the algorithms.

There werethreequestionsthatwillanswerin this paper, namely(1) what the contextsthat could be usedtointroducethe meaningof the multiplication of twofractions?, (2) how to usethese contexts to constructthe student's understandingabout the meaningof the multiplication twofractions, and (3) how the development of learning outcomes achieved by students?

THEORETICAL FRAMEWORK

The philosophy of RME was mathematics as a human activity, which means that the learning process of mathematics first of all should not be connected with mathematics as a deductive system that was well organized and formal, but it should be connected with mathematics as a human activity (Freudenthal, 1971, 1973, in Gravemeijer, 1994). If the mathematics which was learned by the student was connected with a formal deductive system, then the student would view that mathematics was resulted by the human thinking; it was an abstract and was not related to real-life. So, they will think that they could not find mathematics and using mathematics in their life. Learning mathematics should be able to make the students thought that there was mathematics in human activities, and it was be used by them in real life.

There were four main principles in the RME (Gravemeijer, 1991 and 1994, Treffers, 1991, and Julie, 2014), namely:
1. Guided reinvention;
2. The progressive mathematizing;
3. Didactical phenomenology;
4. Self-developed models.

RESEARCH METHODOLOGY

The approach used to develop the students' learning materials and the teacher giude in this research activity was RME. This type of research that was used by the researcher in this study was the design research with three cycles. Things that were presented in this paper what was done by the researcher and what comes out of the third cycle. The data analysis was conducted by video data and the student's work. The steps undertaken by the researcher followed the phases in the development research were developed by Gravemeijer and Cobb.

RESULTS

The research results presented in this paper were limited by the researcher on the third cycle. The aims of the design that was made by the researcher were that students could know about the meaning of multiplication of two fractions and the fractional multiplictation procedure. Before students experienced learning process designed by the researcher, students have learned about fractions in grade four, namely (1) the meaning of fractions, (2) the ordering of fractions, (3) the simplfying of fractions, and (4) the additing and subtracting of fractions. The problemsweregiven to studentsinspiredbythe problems that existin the book thatwritten by Fosnot, andDolk (2002) and the teacher' idea who taught the students in grade five.

Here was presented problems that were given to students, a possible answer to such problems, learning path, and the student' answers:

1. **The problem was given to students:**

   Kiki needed 3 pieces of ribbon for the gift decoration.

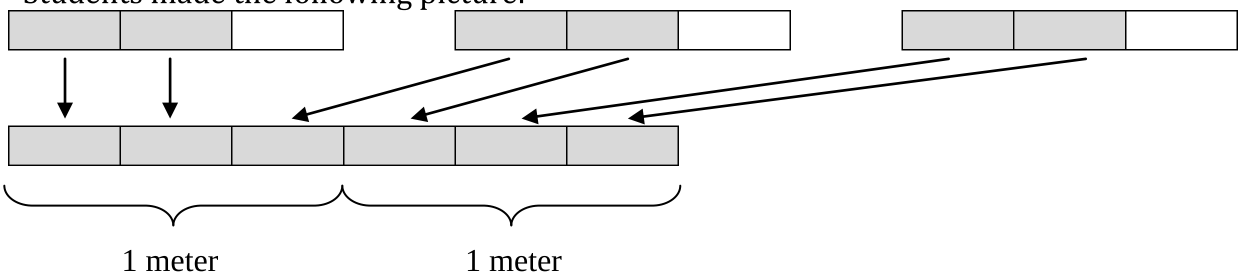
   The length of each ribbon was needed Kiki is $\frac{2}{3}$ meter.

   To fulfillthe needs of a ribbon, Kiki would purchase the ribbon.

   How many meters of ribbon were to be purchased by Kiki?

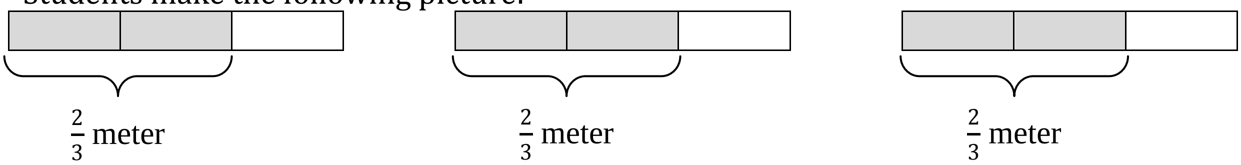
   Possible answers for the problem:

   a. Students made the following picture:

   Thus, the length of the ribbon that needed to be purchased by Kiki was 2 meters.

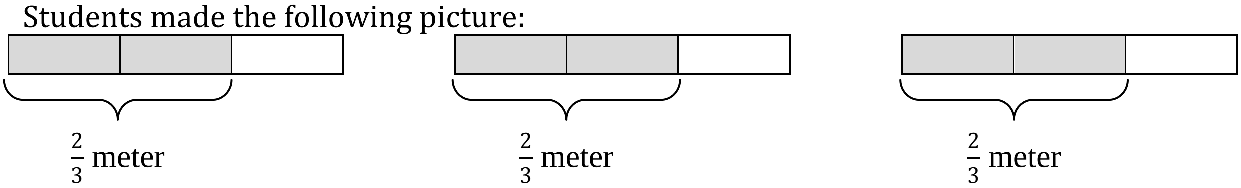
   b. Students make the following picture:

   Students then made the following calculations: $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=\frac{2+2+2}{3}=\frac{6}{3}=2$.

   Thus, the length of the ribbon that needed to be purchased by Kiki was 2 meters.

   c. Students made the following picture:

   Students then made the following calculations: $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=3\times\frac{2}{3}=\frac{3\times 2}{3}=\frac{6}{3}=2$.

   Thus, the length of the ribbon that needed to be purchased by Kiki was 2 meters.

d. Students made the following calculations: $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=\frac{2+2+2}{3}=\frac{6}{3}=2.$

e. Students made the following calculations: $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=3\times\frac{2}{3}=\frac{3\times2}{3}=\frac{6}{3}=2$

f. Students made the following calculations: $3\times\frac{2}{3}=\frac{3\times2}{3}=\frac{6}{3}=2.$

The path of the teaching and learning process:

a. Students formed discussion groups consisting of 2-3 students.

b. Students were required to discuss how to solve the problem of Kiki and wrote the results of their discussions on the poster paper.

c. When students did group discussion, a teacherobserved how students solved the problem. If a student was having problems, the teacher could help students. Help teachers can be accomplished by (1) asking the students to describe the threepiecesof ribbon that will be purchased by Kiki, (2) provided guiding questions, for example: how to add fractions same denominator ?, how to write $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}$in the form of multiplication?, etc..

d. After all the groups complete the discussion, ask two or three groups who have different strategies to present the results of group discussions.

e. Make a class discussion. Bring the discussions that the students came to the conclusion that in order to obtain the result of multiplying an integer by a fraction could be done by multiplying integers with the fractional numerator, and then divided by the fractional denominator.

Answer made by students: from 6 possible answers, there were only 5 emerging, namely the possibility of b, c, d, e, and f.

2. **The problem was given to students:**

Gofil had$\frac{3}{4}$ kg of oranges.

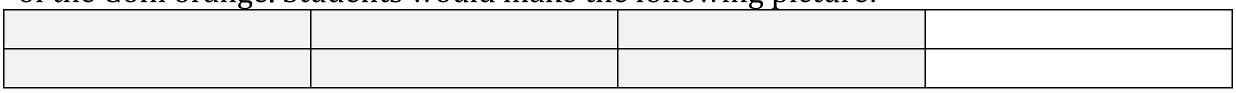
Gofil gave half part of oranges owned to Berto.

How many kg of oranges would be given by Gofil to Berto?

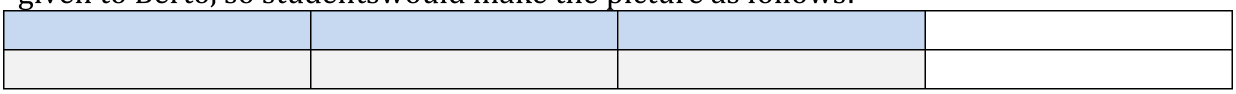
Possible answers for the problem:

a. Students made the following picture:

The gray shaded area was the heavy ofthe orangethat owned by Gofil, ie$\frac{3}{4}$kg. Then, students shorethe Gofil' orange into two equal parts. Students would get half part of the Gofil'orange. Students would make the following picture:



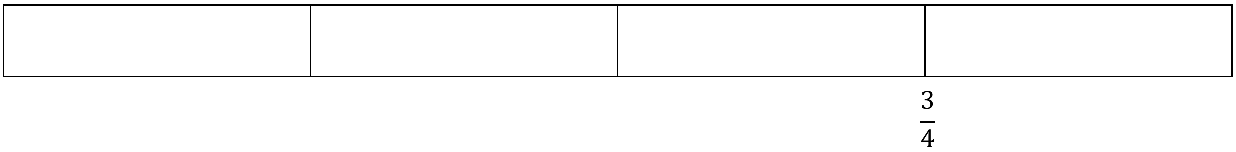
Then, students shaded with different colour to show the half part of the Gofil's orange given to Berto, so studentswould make the picture as follows:



1) The blue shade indicatedthe area of the Gofil'orange given to Berto, that is equal to $\frac{3}{8}$kg. Because there were 3 blue shade parts of 8 parts of a whole.

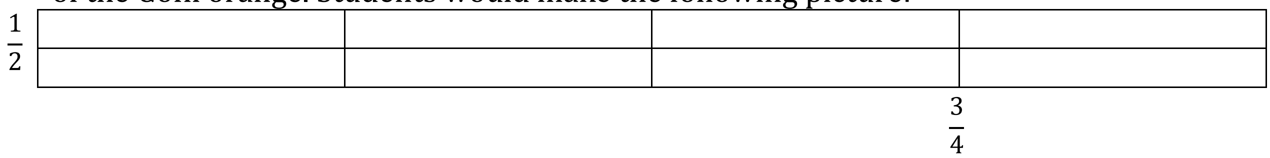
2) The blue shade indicatedthe area of the Gofil'orange given to Berto, that is equal to$\frac{1}{2}$part of$\frac{3}{4}=\frac{3}{8}$kg.Because there were 3 blue shade parts of 8 parts of a whole.

b. Students made the following picture:



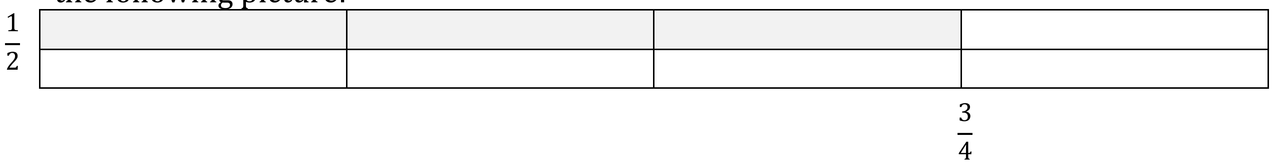
Students annotate the boundary area thatshowed$\frac{3}{4}$, so the weight of the Gofil' orange was represented by the left area of the boundary.

Then, students shore the Gofil' orange into two equal parts. Students would get half part of the Gofil'orange. Students would make the following picture:



Students annotate the boundary area thatshowed$\frac{1}{2}$ part of $\frac{3}{4}$ kg, sohalf of the Gofil 'orange weight was represented by the upper area of the boundary.

Then, students shaded to indicate the area of Gofil'orange given to Berto, as shown in the following picture:



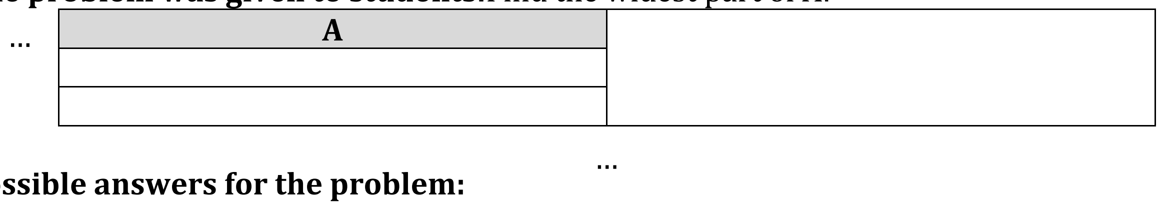
1) The gray shade indicatedthe areas of Gofil'orange given to Berto, that is equal to $\frac{3}{8}$kg. Because there were three blue shade parts of eight parts of a whole.
2) The gray shade indicatedthe areas of Gofil'orange given to Berto, that is equal to $\frac{1}{2}$part of $\frac{3}{4} = \frac{3}{8}$kg. Because there were 3 blue shade parts of 8 parts of a whole.

The path of the teaching and learning process:

a. Students formed discussion groups consisting of 2-3 students.
b. Students were required to discuss how to solve the Gofil problem and wrote the results of their discussions on poster paper.
c. When students did group discussion, a teacher observed how students solve the problem. If a student was having trouble, the teacher could help the student. Help teachers could be accomplished by (1) asking the students to make a picture that describedthe Gofil'orange. After that, the teacher asked the students to describe half part of the Gofil'orange. Then the teacher asked to students, how many kg of oranges given Gofil to Berto?; (2) providing the guided questions and orders, for example: how many kg Gofil'orange?; please, try to drawthe Gofil'orange heavy, how many part of the Gofil'orange given to Berto?;please, try to draw the Gofil'orange given to Berto; how many kg of orange given by Gofil to Berto?, etc.
d. After all the groups completed the discussion, the teacher asked one or two groups who had different strategies to present the results of group discussions.
e. The teacher explains to the students that $\frac{1}{2}$ part of $\frac{3}{4}$ could be written as $\frac{1}{2} \times \frac{3}{4}$. Thus, we would obtained $\frac{1}{2}$ part of $\frac{3}{4} = \frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$.
f. Bring the discussions that the students came to the conclusion that in order to obtain the result of multiplying two fractions could be done by multiplying both the numerator of the fraction and the denominator of the two fractions. In this case, we would obtain$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$.

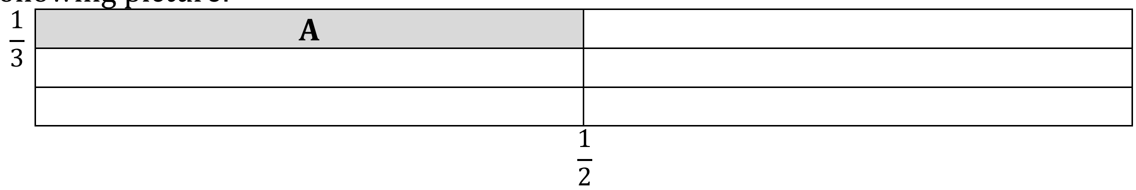
Answer made by students:the four possible answers appear in the results of the student discussion.

3. **The problem was given to students:**Find the widest part of A!



Possible answers for the problem:

a. Students completed the picture and fill in the empty spots in order to obtain the following picture:



b. Students calculated, the widest part of A = $\frac{1}{3}$ part of $\frac{1}{2} = \frac{1}{6}$.
   Becausethere wasone gray shade part of six parts of a whole.
c. Students calculated, the widest part of A = $\frac{1}{3}$ part of $\frac{1}{2} = \frac{1}{3} \times \frac{1}{2} = \frac{1 \times 1}{3 \times 2} = \frac{1}{6}$.
d. Students calculated, the widest part of A = $\frac{1}{3} \times \frac{1}{2} = \frac{1 \times 1}{3 \times 2} = \frac{1}{6}$.

The path of the teaching and learning process:

a. Students were required to solve the problem of seeking the widest part A individually.
b. When students solved the area problem, the teacherobserved how students solve the problem. If a student was having trouble, the teacher couldhelp students. Help teachers could be accomplished by (1) asking questions so that students completed the picture that were in the problem such the students could get the picture which would like in the posibility student' answer, (2) asking students to fill spots still vacant in the picture. If students had difficulty filling in the blanks, then the teacher could help students by providing guided questions, for example: pay attention to the process of sharing large rectangle using the lines of the vertical, how many parts were formed by the division of a rectangle using the vertical line.
c. Two or three students who have different answers asked by the teacher to present the results of its work.
d. Make a class discussion. Remind students about the results of previous class discussions could be concluded that multiplying two fractions could be done by multiplying both the numerator of the two fractions and the denominator of the two fractions. Navigate the discussion so that students could conclude that the widest part A was $\frac{1}{3}$ part of $\frac{1}{2} = \frac{1}{3} \times \frac{1}{2} = \frac{1 \times 1}{3 \times 2} = \frac{1}{6}$.
e. Directed students so that they could conclude again that to obtain the result of multiplying two fractions could be done by multiplying both the numerator of the two fractions and multiplying the denominator of the two fractions.

Answer made by students:the three possible answers appear in the results of student work.

4. **The problem was given to students:**

   Use the follow rectangle to illustrate the statement $\frac{1}{4}$ part of $\frac{1}{2}$ and calculate the results.

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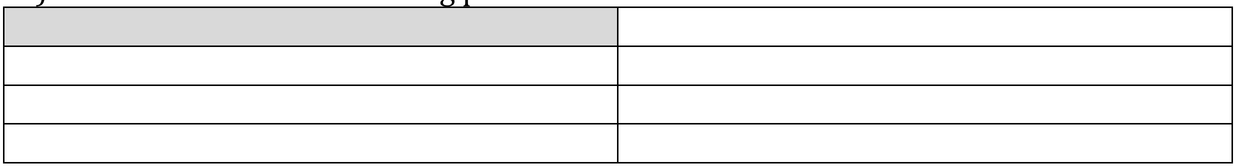
Possible answers for the problem:

a. The possible answers were made by the student to describe $\frac{1}{4}$ part of $\frac{1}{2}$

1) Students made the following picture:

$\frac{1}{4}$



$\frac{1}{2}$

Students stated that the shaded area was $\frac{1}{4}$ part of $\frac{1}{2}$.

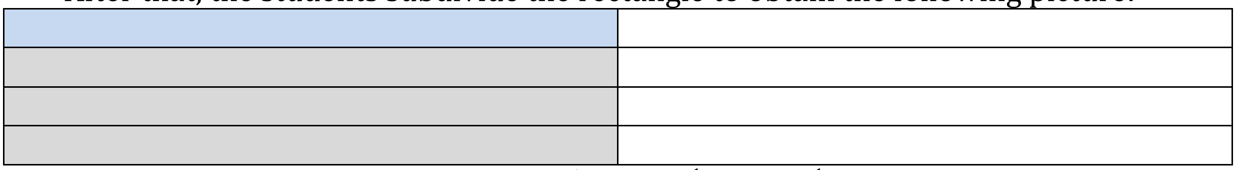
2) Students made the following picture:

$\frac{1}{2}$

Students stated that the gray area shaded was $\frac{1}{2}$.

After that, the students subdivide the rectangle to obtain the following picture:

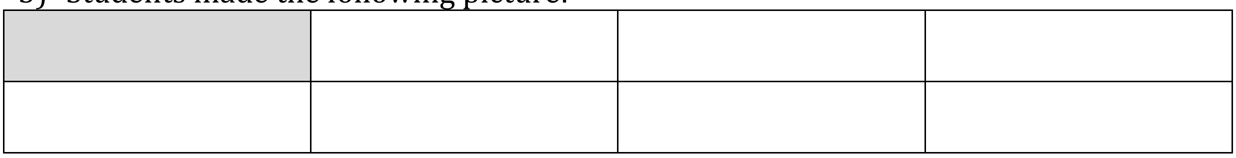
$\frac{1}{4}$



Students stated that the blue shaded $\frac{1}{2}$ areawas $\frac{1}{4}$ part of $\frac{1}{2}$.

3) Students made the following picture:

$\frac{1}{2}$

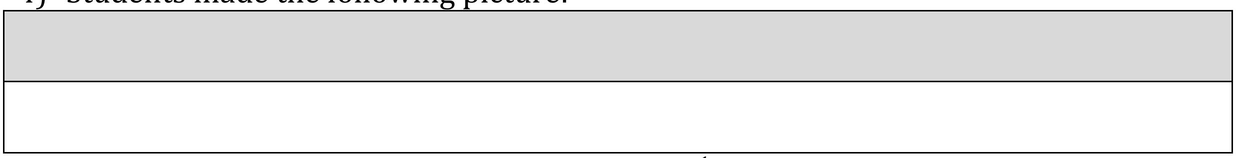


$\frac{1}{4}$

Students stated that the gray shaded areawas $\frac{1}{4}$ part of $\frac{1}{2}$.

4) Students made the following picture:

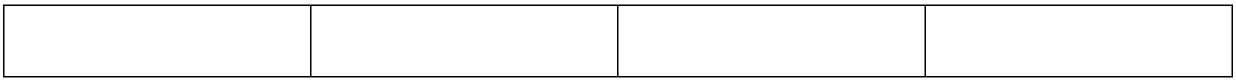
$\frac{1}{2}$



Students stated that the gray shaded area was $\frac{1}{2}$.

After that, the students subdivide the rectangle to obtain the following picture:

$\frac{1}{2}$



$\frac{1}{4}$

Students stated that the blue shaded areawas $\frac{1}{4}$ part of $\frac{1}{2}$.

b. Then, to calculate the amount of $\frac{1}{4}$ part of $\frac{1}{2}$,the possibility undertaken by students were as follows:
   1) Studensts answered$\frac{1}{4}$ part of $\frac{1}{2} = \frac{1}{8}$. Because there wasone gray shade parts of 8 parts of a whole.
   2) Students calculated that$\frac{1}{4}$ part of $\frac{1}{2} = \frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$.
   3) Students calculated that$\frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$.

The path of the teaching and learning process:

a. Students were required to solve the problem of describing and calculating $\frac{1}{4}$ part of $\frac{1}{2}$ individually.
b. When students solvedthis problem, the teacher went around observing how students solve the problem. If a student was having trouble, the teacher could help students. If students had difficulty todescribe $\frac{1}{4}$ part of $\frac{1}{2}$, then the teacher could do so (1) asking the students describe $\frac{1}{2}$on the rectangle that was available; (2) after that, students were asked to write or shading which part of the rectangle which stated $\frac{1}{2}$; and (3) the students were asked to describe the fourth part of the shaded area. If students have difficulty to calculate$\frac{1}{4}$ part of $\frac{1}{2}$, then the teacher could help students by providing guided questions, for example: (1) pay attention to the first division process, how many parts were formed by the division process; (2) pay attention to the second division process, how many parts were formed by the division process; and (3) consider the result of two of divisionprocess, how many parts were formed by the first and second division process.
c. Two or three students who have different answers asked by the teacher to present the results of its work.
d. Make a class discussion. Remind students about the results of previous class discussions could be concluded that to obtain the result of multiplying two fractions could be done by multiplying both the numerator of the two fractions and multiplying the denominator of the two fractions. Navigate the discussion so that students could conclude that $\frac{1}{4}$ part of $\frac{1}{2}$ was $\frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$.
e. Directed students so that they could conclude again that to obtain the result of multiplying two fractions could be done by multiplying both the numerator of the two fractions and multiplying the denominator of the two fractions.

Answer made by students:the four possible answers about drawing$\frac{1}{4}$ part of $\frac{1}{2}$andthe three possible answer about calculating $\frac{1}{4}$ part of $\frac{1}{2}$appear in the results of student work.

5. **The problem was given to students:**calculate the follow multiplication $5 \times \frac{3}{7}$.

Possible answers for the problem:

a. $5 \times \frac{3}{7} = \frac{3}{7} + \frac{3}{7} + \frac{3}{7} + \frac{3}{7} + \frac{3}{7} = \frac{3+3+3+3+3}{7} = \frac{15}{7} = 2\frac{1}{7}$.
b. $5 \times \frac{3}{7} = \frac{5 \times 3}{7} = \frac{15}{7} = 2\frac{1}{7}$.

The path of the teaching and learning process:

a. Students were required to calculate $5 \times \frac{3}{7}$.

b. When students did group discussion, a teacher went around observing how students solve the problem. If a student was having trouble, the teacher could help students. The teacher aid process could be done as follows: (1) ask the students to describe or write down what it means $5 \times \frac{3}{7}$., and (2) if the student had not been able to interpret what was the meaning of $5 \times \frac{3}{7}$, then the teacher asked what that means 2 x 3.

c. One or two students who have different answers asked by the teacher to present the results of its work.

d. Make a class discussion. If the student answers that appear only in the first possibility, the teacher could remind about the class discussion results on the previouse meeting, i.e. students conclude that in order to obtain the result of multiplying an integer by a fraction could be done by multiplying integers such as the numerator fractional and divided by the denominator fractional. Navigate the discussion so that students can conclude that $5 \times \frac{3}{7} = \frac{5\times3}{7} = \frac{15}{7} = 2\frac{1}{7}$.

e. Directed students so that they could conclude again that to obtain the result of multiplying an integer by a fraction could be done by multiplying integers with the fractional numerator and divided by the denominator fractional.

Answer made by students:the two possible answers appear in the results of student work.

6. **The problem was given to students:**calculate the follow multiplication$\frac{5}{6} \times \frac{12}{15}$

Possible answers for the problem:

a. $\frac{5}{6} \times \frac{12}{15} = \frac{5\times12}{6\times15} = \frac{60:30}{90:30} = \frac{2}{3}$.

b. $\frac{5}{6} \times \frac{12}{15} = \frac{5}{6} \times \frac{4}{5} = \frac{5\times4}{6\times5} = \frac{20:10}{30:10} = \frac{2}{3}$.

The path of the teaching and learning process:

a. Students were required to calculate $\frac{5}{6} \times \frac{12}{15}$individually.

b. When students solvedthis problem, the teacher went around observing how students solve the problem. If a student was having trouble, the teacher could help students. If the student was difficult to calculate the fractional multiplication, then ask the student to describe what was the meaning of $\frac{5}{6} \times \frac{12}{15}$. If students had difficulty describing $\frac{5}{6} \times \frac{12}{15}$ thatwas interpreted as$\frac{5}{6}$ part of $\frac{12}{15}$, then the teacher could do so (1) asking the students describe $\frac{12}{15}$by using a rectangle; (2) after that, students were asked to write or shadewhich part of the rectangular section that stated$\frac{12}{15}$; and (3) the students were asked to describe the $\frac{5}{6}$part of the shaded area. If students have difficulty calculating $\frac{5}{6}$ part of $\frac{12}{15}$, then the teacher could help students by providing guided questions, for example: (1) pay attention to the first division process of the rectangle, how many parts were formed by the division process; (2) pay attention to the second division process of the rectangle, how many parts were formed by the division process; and (3) consider the result of the first and second division process, how many parts were formed by the division process.

c. Two or three students who had different answers asked by the teacher to present the results of its work.

d. Make a class discussion. Directed students so that they could conclude again that to obtain the result of multiplying two fractions could be done by multiplying both the numerator fractional of the two fractions and multiplying the denominator fractional of the two fractions.

Answer made by students:the two possible answers appear in the results of student work.

CONCLUSIONS

The student learning materials has been tried out on students in the 5th grade at a private elementary school in Yogyakarta. The results of the trial were as follows:

1. Kiki problem could lead students to the conclusion that to obtain the result of multiplying an integer by a fraction could be done by multiplying integers with the fractional numerator and divided by the denominator fractional.
2. Gofil' orange problem could lead students to get the conclusion that to obtain the result of multiplying two fractions could be done by multiplying both the numerator fractional of the two fractions and multiplying the denominator fractional of the two fractions.
3. The problem about calculating$5 \times \frac{3}{7}$ could bestrengthen students' understanding about the meaning and the procedur of multiplication between an integer and a fraction.
4. Problem (a) seek the widest part, (b) describe and calculate the results of the $\frac{1}{4}$ part of $\frac{1}{2}$, and (c) calculating $\frac{5}{6} \times \frac{12}{15}$could strengthen students' understanding about the meaning and the procedure of multiplication of two fractions.
5. The context ofthe Kiki' ribbon and the Gofil'orange could help students to construct about (a) the meaning and the procedure of multiplication of an integer and a fraction, and (b) the meaning and the procedure of multiplication of two fractions.

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DEVELOPING BIOLOGY MODULE ON EVOLUTION TOPIC USING METACOGNITIVE BASE FOR SENIOR HIGH SCHOOL STUDENTS CLASS XII

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Abstract

Evolution is one of biology material which is complex and related to several disciplines. Based on observation, evolution is difficult to be comprehended by majority of student because students could not meet its evidence directly. Besides, the topic was frequently delivered using lecture method as it is sufficiently effective to be taught in a restricted time. As the effect, the learning could not reach the latest curriculum (K13) demand, is students' comprehension and metacognitive ability. In addition, supported learning material has not been available yet. Thus, a development research has been conducted to respond this problem. The research applied 3 (three) steps of 4-D models, consist of define, design, and develop. The research subjects were 23 of students of class XII SMA Negeri 1 Batusangkar and 26 undergraduate students. The data generated from validity and practicality instruments then analyzed descriptively in the form of percentage. The research result showed that this learning module is valid in criteria 87,49 %, practical by teachers in criteria 85,25% and practical by students in criteria 86,18%. It can be concluded that the product is categorized as valid and practical learning module.

Key word : learning module, evolution, metacognitive

Key words— Misconception, evolution, module.

INTRODUCTION

Evolution is one of biology learning material which is complex and has interrelated with number of discipline. Evolution explain changes on living things during over past time relatively. This topic presents facts, processes or events which express unreachable phenomens in time and location thus sufficiently difficult to be learned. The survey toward students' of SMA Negeri 1 Batusangkar at 28 of July 2015 (20 respondents) informed that the limitation of evolution evidence in daily life has become one inhibition for understanding the material.

Besides, delivery method-lecturing- and incomplete content in learning media reduced students' enthusiasm. Eventhough teachers has stimulated students by doing some tasks, the effort has not work well. Furthermore, this condition caused misconception and unsatisfied learning achievement. Two previous research, Ulfa (2015) and Oktavia (2015) found that first year students in Biology department experienced misconception in evolution and one of biology learning book used by mostly high school students contained misconception.

In 2015, the curriculum 2013-matched book has been written by independent authors.

After analysing this book, I found that the book has not contained learning material which is covered in basic competency determined. In addition, the book has not directed students' metacognition development as curriculum 2013 demand.. Metacognition is defined as someones' ability to control thinking, to deciding, to opting, to selecting, and to asses their thinking pattern (Prawiradilanga, 2009: 89)[7]. Metacognition and analysis ability can be presented by teacher give a clear instruction on what students should do or what kinds of learning resources are suitable. Sadiman in Rohani (2010: 186) tell that one of suggested learning resources is module. Module can help independent learning. and drill students to reflect and evaluate learning process. Using module during learning enhance students' activity so giving positive influence toward students' metacognition.

Module base on metacognition is assumed effective for students to understand evolution topic with several consideration; overcoming time and place, developing suitable learning strategy, drilling students to critically think, shaping matacognition based learning environment (students centered), stimulates hierarchical thinking, creating learning situation and media based on 2013. Related to the problems, we developed a biology module on evolution topic using metacognition for senior high school students class XII.

RESEARCH METHOD

This development research aims to generated new product by using 4D models. The study has been conducted in Natural Science and Mathematics Faculty Campus at State University of Padang starting from July, 2015 to January, 2016. Afterthat, the product is tested to teacher and students class XII at SMA Negeri 1 Batusangkar and first year bachelor students in field of Biology.

The subject consist of 23 students of SMA Negeri 1 Batusangkar and 26 first year students in bachelor degree program who are registered in 2015. Products is validated by 3 lecturer of Biology departement at State University of Padang, 1 lecturer of STKIP PGRI Padang, 1 Biology teacher of SMA Negeri 1 Padang and 2 Biology teacher of SMA Negeri 1 Batusangkar. Research object is module biology using metacognition base on topic evolution.

There are two types data, primer data generated from research subject and secondary data generated from validity and practicality test.

The research stages consist of 4-D (*four-D models*) developed by Thiagarajan, Dhoroty S. Semmel and Melvyn I. Semmel. According to Trianto (2007: 65-68), the stages are : *define*, design, develop, and disseminate (limited scope).

1. **Define**

In this stage, learning requirements are determined through analysing the core competence, basic competence, and learning material according to curriculum 2013. The detail steps are:

a. Front-end analysis
   The aim is to explore and determine basic problem faced by teacher and student and found its solution.
b. Analysing the students
   The aim is to recognize students' characteristic, learning motivation, psychomotoric ability, and ages. In this case, students of SMA Negeri 1 Batusangkar were the target
c. Task analysis
   The aims is to identify and analyse sort of ability which must be mastered by students through elaborating Core Competence, Basic Competence and Learning Indicator.
d. Concept analysis
   The step consist of concept identification. Then, these were arranged systematically in order easily understood.

e. Formulating learning purposes
Learning purposes were formulating based on learning indicator as basic for module development.

2. Design stage

The stage aimed to prepared learning material, which is consist of three activity, are:

a. Selecting the media
The activities were task analysis, concept analysis, students characteristic and learning purposes, the directed to choose module as the media type.

b. Selecting the format
The stages consist of designing the content frame and developing the content.

3. The development stage

The aim of the stage is to generated a valid and practical module by consulting with experts for content validity and empirical try-out. Experts/validator correction ad suggestion were utilised to revise the module. Here are name of expert in Table 1.

Table 1. List of experts as validators

No.	Name	Institution
1.	Drs. Anizam Zein, M.Si.	Lecturer at Biology Education Study Program of State University of Padang
2.	Fitri Arsih, S.Si., M.Pd.	
3.	Rahmawati D., M. Pd.	
4.	RRP Megahati, S.Si., M.Si.	Lecturer at Biology Study Program of STKIP PGRI Sumbar
5.	Dra. Febria Suhartri, M.Si.	Biology Teacher of SMA Negeri 1 Padang
6.	Yossi Lolita, M.Si.	Biology Teacher of SMA Negeri 1 Batusangkar
7.	Dra. Syafriati Rasyid	

After validity process, the module were tested for its practicality on two different subject, students class XII SMA Negeri 1 Batusangkar and first year students of Biology Study Program, Bachelor Program of State University of Padang. Teh activity aimed to explore the module easiness, time consuming, benefit for student and its effect as learning media. Instrument practicality were filled by teacher and students after applying the module in a learning condition. The teacher involved were presented in Table. 2.

Table 2. Practicality test respondents

No.	Name	Institution
1.	Yossi Lolita, M.Si.	Biology Teacher of SMA Negeri 1 Batusangkar

2.	Dra. Syafriati Rasyid	Biology Teacher of SMA Negeri 1 Batusangkar

The procedure of practicality test are:

1. Teacher run learning normally using metacognition module
2. Teacher fills the practicality instrument by adding suggestion.
3. Students use the module in learning process then fill in the practicality instrument.

The data obtained are analysed statistically using percentage. Criteria used are modified from Purwanto (2009: 82) as following:

90% - 100% = very valid
80% - 89% = valid
60% - 79% = sufficiently valid
0% - 59% = poor

For practicality, the criteria are :

90% - 100% = very practical
80% - 89% = practical
65% - 79% = sufficiently practical
55% - 64% = poor
0% - 54% = very poor

RESULT AND DISCUSSION

1. Results of Define Stage

a. Front end Analysis

Based on information on survey toward 20 students of SMA Negeri 1 Batusangkar on 28 July 2015, majority students thought that evolution topic is difficult and abstract. An interview with Dra. Febria Suhatri, M.Si., on 14 Agustus 2015, it can be known that learning obstacle is learning resources which is suitable to curriculum 2013 and reduced time allocation because of Final Examination. Besides, curriculum demand metacognition on learning material.

b. Students analysis

Majority of students are on 16-18 years old. According Piaget, these age group has shown abstract thinking ability, logic, making conclusion, and developing hipothesis. It can be concluded that students are able to apply learning media and potentially can develop metacognitive.

c. Analisis Tugas

The identified concept are definition of evolution, evolutionary ideas, evolution theory, evidence of evolution, and speciation. Later, learning purpose are arranged.

2. Result of Design Stage

The modul are designed by applying *Microsoft Office Publisher 2007, Microsoft Office Picture Manager 2007* and *Photo Shop*. The components of module are *cover, profile sheet,* guidanc, Core Competence, Basic competence, learning activity, assesment, and key answer.

a. Result of Development stage.

The modul were assessed as valid criteria. The score details presented in Table 3.

Table 3. Validation score

No.	Assesment component	(%)	Judgement
1.	Content	88,57	Valid
2.	Language	87,35	Valid

3.	Organisation	87,14	Valid
4.	Graphic	87,43	Valid
5.	Metacognition	86,98	Valid
Total		437,47	
Average		87,49	Valid

Overall score informed that module reach valid criteria so can be applied in learning process.

The module also reach practical criteria for both category, teacher and students. The detail score were presented in Table 4. While, students practicality gain shown in Table 5.

Table 4. Practicality score by teacher

No	Aspect	(%)	Criteria
1.	Convenience of using	90	Very practical
2.	Time consuming	80	Practical
3.	Benefit	86	Practical
4.	Metacognition	85	Practical
Total		341	
Average		85,25	Practical

Percentage as much as 85,25% implied that the module practically applied durung learning process. Besides, point 84,87% and 86,14% implied the module is practical to be used by students of SMA Negeri 1 Batusangkar (Table 5) and first year student (Table 6) subsequently.

Table 5. Practicality score by students of SMA Negeri Batusangkar

No.	Aspect	(%)	Criteria
1.	Convenience of using	83,48	Practical
2.	Time consuming	84,35	Practical
3.	Benefit	87,20	Practical
4.	Metacognition	84,44	Practical
Total		339,48	
Average		84,87	Practical

Table 6. Practicality score by first year students

No	Aspect	(%)	Criteria
1.	Convenience of using	86,79	Practical
2.	Time consuming	85	Practical
3.	Benefit	87,25	Practical
4.	Metacognition	85, 73	Practical
Total		344,71	
Average		86,18	Practical

B. Discussion

1. Module validity

Based on content component, it is acceptable that content has matched and refered to the curriculum. According to Depdiknas (2008: 8), the learning material developed must meet the curriculum requirements. Besides, it has to fixed with students ability, development phase and needs such Sakiman (2012: 135) explain that the module should be accommodated to interest, attention, and needs. The contentt also enrich students knowledge, logic, and good instrument and key answer. The content validity is supported by understoodable, communicative, interactive, and students' language development. Font type and size used helped students to dig the meaning. The idea proposed in a simple way (2012: 139). As Prastowo (2011: 123) suggested that simple, clear, and effecient sentence help students compehension.

Content were presented sistematically. The hierarchy of ideas shown structure and component relevance. Main and complementary ideas were well distinguished, and graphically use attractive ilustration so enhance students motivation (Asyhar, 2012: 155). Finally, the module has also included seven components of metacognition.

2. Module Practicality

The three indicator of practicality reach practical criteria. The module are easily used by both teacher and students. Besides, it can be utilised by students effieciently because they can set up their own learning speed. Nasution (2008: 205) explained that one of excellence of using modul is facilitate students to learn in their own pace. Respondents also expressed that benefit for teacher because it can control students activity, helps students to understand material and have independent learning, and create a joyfu learning.

Metacognition complements which appeared can direct students to know their pre-knowledge, control the knowledge, proposing the questions, and collecting related information. Furthermore, students are able to arrange the information, think logically and proposing metacognitive questions in group, connecting to real world, making link preknowledge and post knowledge, and making inference. The seven indicator improve students; metacognition then change their mindset toward evolution topic, it is easily understood.

Eventhough the module are tested toward different level of education, high school and undergraduate students, it is practically tested on both subject. The possible explanation is similarity between those in mental development stage; preoperational formal.. In addition, both group age are similar in metacognition developing ability.

The colours, font, and illustration prepared on modul attracted those age group. Besides, colour using, image, attracted students to read, escaping their boring time. In this case, Prastowo (2011: 124) said that figure/image is needed to make content clearer, as it contains a simply visual message (Sudjana and Rivai, 2011: 8-9).

In term of benefit, it contribute well for students. This is an important pointt as a beneficial learning module can be detected from the convenience of users (Van den Akker, cited in Rochmad, 2012: 69-70.

CONCLUSION

Overall, the learning module created is valid, practical, and support learning based metacognition. We recommend teacher and students to use the module during learning.

Research limitation

This is a pilot project in a development research. Some further and broader test are needed to strengthen the quality and replicability. The more important, the module effectivity to influence students learning result and metacognition ability is required.

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THE SELF-REGULATION OF JUNIOR HIGH SCHOOL STUDENTS IN MATHEMATICS CLASSROOM USING METACOGNITIVE GUIDANCE

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Abstract

Students' self-regulation is their ability to develop, to manage, and to control their thought, behavior, and environment in order to achieve their learning goals. Students with this ability can establish a strong and comprehensive understanding in learning process. This research aims to study the self-regulationof junior high school students which learningby using metacognitive guidance in mathematics classroom. Two groups of the VIII grade students in a Junior High School were selected to learn about circle. One group was learning through metacognitive guidance (MG), another group was learning through scientific learning (SL) which is regularly used in their school. In MG classroom, students were guided to use self-addressed metacognitive questions in solving problems. Those questions also used by teacher as a guidance for students to understand the mathematical concepts they learned. After learning the circle materials in several classroom meetings, students were asked to fill out a self-regulation questionnaire. The data of their self-regulation then compared with the data from SL group. The difference of thestudents' self-regulation from each group was analyzed by using two independent sample t-test after transformed into interval data using Method of Successive Interval (MSI). The results showed that theself-regulation of the students which learn through metacognitive guidance was significantly better than the self-regulation of the students which learn throughscientific learning.

Keywords: self-regulation, metacognitive guidance, scientific learning

INTRODUCTION

Affective aspects of students can be a picture and embodiment of appreciation to its cognitive abilities in real life. The purpose of learning mathematics also stressed to the importance of affective values instilled in mathematics. These values include respect for the usefulness of mathematics in life, those are having a curiosity, readability, consideration, determination, and confidence in solving problems are the purpose of our national education (Permendiknas No 22 Tahun 2006 tentangStandar Isi (SI) Mata PelajaranMatematikalingkuppendidikandasar). Therefore, in the mathematics learning process, students are also expected to build their affective aspects.

One of affective aspects that are important to students is self-regulation. Self-regulation can be defined briefly as a self control, and self-management. This aspect consists of three phases, each phases contains some important processes that take place in a cyclic manner (Boekaerts, Pintrich, &Zeidner, 2000), which is a process of task analysisself-control and the self judgment. Self-regulation is very important for students because this aspect establish three important psychological function in the study, those are: cognitive, motivational, and metacognitive which operates cyclically in the formation of abilities and expectations of student success. In addition, self-regulation can encourage the establishment of interaction between the private and the student's behavior, as well as the environmental conditions mathematics (Nani, 2012). Sumarmo (2012) also states that self-regulation contains the positive attitudes that support the growth of the culture and character of students like nature persevering, flexible, persistent, metacognitive thinking, open-minded and confident. Self-regulation can be said strongly supports the achievement of the core competencies of mathematics contained in Permendikbudno.68 Year 2013 about curriculum SMP-MTS, namely respect and appreciate the honest behavior, discipline, responsibility, caring (tolerance, mutual assistance), mannered, confident, to interact effectively with the social and natural environment within reach of the association and its existence.

Many research data show that self-regulation has a positive impact on learning and achievement of learning outcomes, in contrast to low self-regulation becomes one cause of low learning achievement. Although a student has a good level of intelligence, but without supported by the ability of self-regulation, then these students still will not be able to achieve the optimal (Susanto, 2006). Sumarmo (2006) also concluded that the higher the students 'ability to think mathematically, the higher the quality of the students' self-regulation, and vice versa. However, some studies also indicate a lack of quality of the students' self-regulation.

Research conducted by Fauzi (2011) states that self-regulation in the category of students is still low for all groups of students. Furthermore Farlina (2013) also found that self-regulation of students in the class with regular learning in the low category. Research conducted by Sumarni (2014) shows that the self-regulation of students is still not satisfactory, especially in some of the indicators. For example, the indicator "utilize and find relevant learning resources", students are still dependent on textbooks and worksheets that are owned by the teacher, even though the students had textbooks is limited. Self-regulation of students is still low in the indicator "sure of himself". Students are still less confident express their ideas and opinions in class discussions. Students still must be driven by teachers beforehand to express their opinions in front of the class. Students will present their thoughts tended to be afraid if the settlement they are wrong. They often ask teachers in advance whether their answers are correct, then they dare to disclose to her classmates.

The process of the self-regulation in problem solving allows the establishment of a strong and comprehensive understanding of the problem with a logical reason. This kind of understanding is something that is always emphasized when the ongoing learning of mathematics at all levels of education, because the strong compliance with the mindset of mathematics (Anggo, 2011). Some explanation of the foregoing indicates the need for a good approach in mathematics learning to develop students' self-regulation. This is because the applied learning can affect the ability of the student (Dimyati, 2012; Febrianela, 2013; Krismiati, 2013). Joyce, Weil, & Calhoun (2009) says that good teaching is teaching that embraces learning experience without limits on how ideas and emotions interact with the atmosphere of the classroom and how they can be changed in accordance atmosphere also changed. Besides learning needs to involve students in tasks laden cognitive and affective, and guide them how to do these tasks productively.

Good learning processes, one of them can be done by involving metacognitive processes in mathematics learning. Metacognition can be defined as the knowledge, awareness, and control the thought processes themselves. Matlin (2003) states that metacognitive also a process in which the student is able to direct himself while learning, able to plan, organize, orient themselves and perform self-evaluation at various levels during the process of obtaining information. This indicates that the metacognitive process is closely related to self-regulation. In addition, ways to implement metacognition in solving mathematical problems, among others, with beliefs and intuitions, knowledge, and self-regulation (McLoughin&Hollingworth 2003; Pierce, 2003 in Kamid, 2013). Nani (2012) also stated that the ability of students active metacognitive, who have an incentive to learn and actively participate in the learning process describe their self-regulation. It is also supported by PISA (2000, in Kramarski&Mevarech, 2004) which says that the metacognitive discourse is an essential condition for acceptance of knowledge within and outside school and in life-long learning. Therefore, aspects of metacognition in learning is needed to be able to develop students' self-regulation (Foong, 2002; In'am, 2012; Kamid, 2013).

Involving metacognition in learning mathematics can be done with the metacognitive guidance approach developed by Kramarski (Kamid, 2013). Metacognitive guidance is based on IMPROVE learning techniques suggested by Mevarech&Kramarski (Kramarski, 2004). This approach uses the self-addressed metacognitive questions, which consists of four metacognitive questions that can guide students in developing capabilities. The four questions are: (1) comprehension questions, (2) connection questions, (3) strategic questions, and (4) reflecting questions. The fourth question on this approach are related to students 'self-regulation, which is expected to facilitate the development of students' self-regulation.

Based on those description above, researcher need to do a study on students' self-regulation by applying metacognitiveguidance on learning mathematics. Learning with metacognitive guidance implemented by familiarizing students to ask and answer questions metacognitive (self-addressed metacognitive question) at every stage of learning which is done in a small group discussions, particularly in resolving the issue. Teachers also use a metacognitive questioning when introducing new concepts, while helping students in small groups, and while reviewing on discussions between groups at the end of the study.

The aim of this research is to study the self-regulation of junior high school students which learning by using metacognitive guidance in mathematics classroom. The main research question in this study is: Is the self-regulation of junior high school students which learning by using metacognitive guidance better than students which learning by regular learning?

THEORETICAL FRAMEWORK

Self Regulation

The term self-regulation related to the term independent learning and self-regulated learning (Sumarmo, 2006).Self-regulation is a proactive process in which a person consistently regulates, and manages his thought, emotions, attitudes and environments to reach academic goal (Boekaerts and Corno, 2005).Self-regulation related to time management, goals setting, efforts and perseverance in completing difficult tasks and performance monitoring of a person, that is one of the key components to success in life. Kamarski&Revach (2009) says that the students organize themselves on a level they become an active participants in their own learning process.

Based on social cognitive perspective, the process of self-regulation is described in three rotating phases and forming a cycle as in Figure 1. Each phase of the cycle of self-regulation, in which there are processes that occur interrelated (Boekaerts, dkk., 2000).

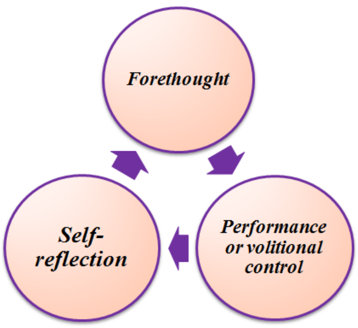

Figure 1. The Cycle of Self Regulation Process (Zimmerman in Boekaerts, dkk 2000)

1) *Forethought*

Forethought phase relates to the processes that influence that precedes the effort to act, and also includes the process in determining the steps to achieve the goals he has set. There are two categories that are closely interwoven in a phase of forethought, ie task analysis and self motivation.

2) *Performance or volitional control*

This phase includes the processes that occur during a person acts in an effort to achieve the goals set in the previous phase. This phase consists of self-control and self observation.

3) *Self Reflection*

This phase includes the process that occurs after someone made an effort to achieve the goals that have been set, and the influence of the response to his experience. Self-reflection phase consists of self judgment and self reaction.

In this study, self-regulation is the process of independent students organize and manage themselves in learning process. *Self-regulation* consist of task analysis, self-motivation, self-control, self-observation, self-judgment and self-reaction aspect. These aspects are described in several indicators, those are the goal setting, planning how to learn, self-efficacy, outcomes expectations, learning interest, learning orientation, self-instruction, imagery, focusing attention, learning strategies, self-recording, self-experimentation, self-evaluation, understanding causal attribution, self-satisfaction, and adaptive or defensive attitude.

Metacognitive Guidance

Metacognitive guidanceapproach is based on IMPROVElearning techniques suggested byMevarech&Kramarski in 1997 (Kramarski, 2004; Kramarski, 2006). Three important components in IMPROVE methods are usingself-addressed metacognitive question, cooperative learning, dan systematic provision of hed back-corrective-enrichment. In the metacognitive guidance approach, learning processeswere emphasized on two main parts, namely (1) the application using a self-addressed metacognitive question contained in the method IMPROVE and (2) the exercise strategy to give mathematical explanation and feedback (Kramarski, 2004; Kramarski 2006 ; Maryanti 2012).

Learning using metacognitive guidance is using four metacognitive questions, that *the comprehensionquestions,connections questions,* and *strategic questions.*

1) *The Comprehension Questions*

This question is designed to encourage students to imagine and think of the problem or the question before solving it. In the comprehension question, students understand and explain the problem. Comprehension questions includes questions such as: "What is the problem in this task?", "What are these problems means?", “What information that I have and don’t have in this problems?” And "What is the meaning contained in this mathematical concept?"

2) *The Connection Questions*

This question is designed to encourage students to focus on similarities or differences in the problems that they do now or tasks they have done previously, are also a variety of concepts they have learned in order to be used in solving the problem. Example of this questions are "How this task with the previous task, is there a difference? Explain! ", or" What conceptsare related to this issue? "

3) *The Strategic Questions*

This question is designed to encourage students to consider the appropriate strategy in solving a given task or problem and what reasons can be given. Examples of this questions are, "How do I can solve this problem?", "What steps can I take?".

4) *The Reflecting Questions*

This question is designed to encourage students to reflect on their understanding and intuition during the learning process. For example, "Does this answer make sense?", "What if I use this steps for other issues?",or "How can I double-check the results of my answer?"

The learning process in this study using the metacognitive guidance which emphasizes in the self-addressed metacognitive questions, that consists of four metacognitivequestions,

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namely: (1) comprehension questions (questions comprehension; (2) the connection questions (questions connections); (3) strategic questions (question the strategy); and (4) reflecting questions (questions reflection) with the method of discussion and question and answer. Examples of such questions are printed on the worksheet. the four metacognitivequestions are used by students in solving the task, also used by teachers in instilling the concepts of mathematics, and to provide a scaffolding to students when solving problems.

METHOD

The method of this research is quasi experiment with nonequivalent control group design. This research was conducted by comparing two groups of students. One group was learning through metacognitive guidance (MG), another group was learning through scientific learning (SL) which is regularly used in their school.The research procedures are shown in Figure 2.

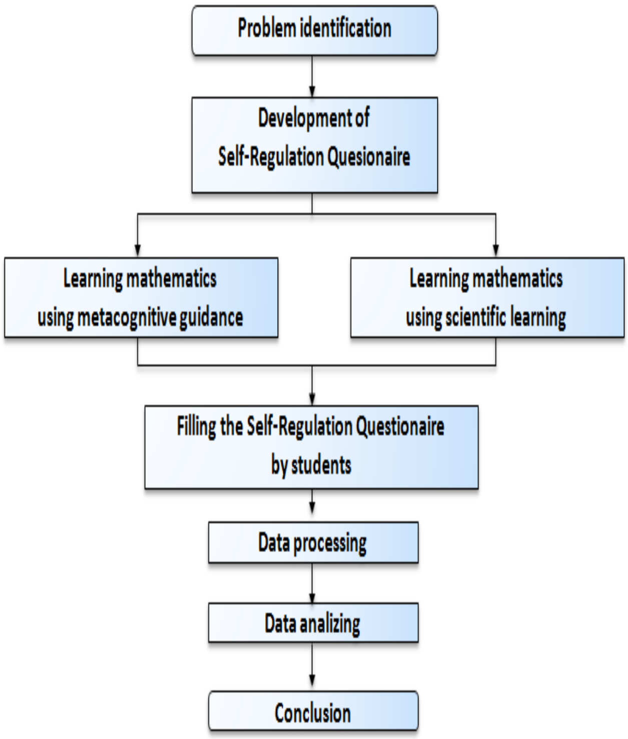

Figure 2. Research Procedure

The Procedure in development of self-regulation questionnaireincludes making the questionnaire framework, drafting the questionnaire, expert review, small group students review, and field trials. After some revision on the draft, the final script of the questionnaire were use to get the data of students self regulation.

The subject of this research areVIII grade students in a Junior High School inKabupaten Bandung Barat.The research was conducted in second semester of 2014-2015 academic year.After the questionnaire data were collected, the difference of thestudents' self-regulation from each group was analyzed by using two independent sample t-test (by using software *SPSS*) after transformed into interval data using Method of Successive Interval (MSI).

RESULT AND DISCUSSIONS

Self-regulation of students was measured by the results of a questionnaire which represents the indicator of students' self-regulation. Those aspects that are measured are the task analysis, self-motivation, self-control, self-observation, self-judgment and self-reaction. These aspects are further elaborated in several indicators, namely the goal setting, planning how to learn, self-efficacy, outcomes expectations, learning interest, learning orientation, self-instruction, imagery, focusing attention, learning strategies, self-recording, self-experimentation, self-evaluation, understanding causal attribution, self-satisfaction, and adaptive or defensive attitude. Self-regulation questionnaire given after students acquire learning in each group. Questionnaire data that has been transformed into interval data is further analyzed to determine whether the students' self-regulation who learn using metacognitiveguidance is better than the students' self-regulation who got a scientific learning.

Descriptively, the average of students' self-regulation in *MG* group was higher than the *SL* group. The difference in average both groups was 5.10 points. Statistically, the self-regulationdata were tested for normality and homogeneity at significance level α = 0.05 using software *SPSS*. After testing the Kolmogorov-Smirnov, its obtained sig. 0.74 for the *MG* group and 0.200 for the *SL* group. Therefore it concluded that the questionnaire data were normally distributed. Then Levene homogeneity test results obtained sig. = 0.887> α = 0.05. So it was concluded that the variance of self-regulation data for both group were homogeneous.

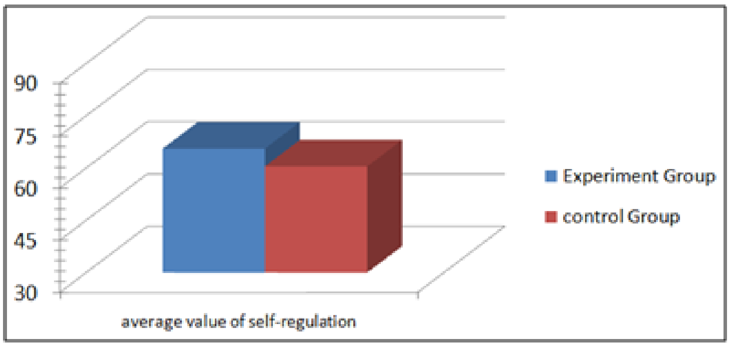

Figure 3. The Average value of Students' Self-Regulation

The students' self-regulation data which were normal and homogeneous thenwas tested differences in their mean using t-test. From the test results of the parties with the t-test values obtained ½ (Sig.) = 0.015 which is smaller than the significance level α = 0.05. This means that the average self-regulation experimental group was higher than the average self-regulation control group. It can be concluded that self-regulation of students in the group with metacognitiveguidance is better than the self-regulation of students in the group with a scientific learning.

The average of students' self-regulation who received metacognitiveguidance was in the medium category. The results obtained due to the metacognitiveguidance learning approach that trains students to recognize, control, and manage the process of thinking in order to achieve the learning objectives well. Awareness, control and self-management was a really good support the formation of students' self-regulation in learning process. Metacognitive questions used as a guide in solving the problem, can train students to understand and manage knowledge in relation to the problems faced, and examine his work carefully. Maryanti (2012) stated that metacognitive aspects as part of the learning associated with metacognitive approach is very important to be developed so that students are able to understand and control the knowledge that has been gained in learning activities.This is in line with research Kramarski and Mevarech (2004) which states that in identifying errors and giving mathematical explanation, which are indicating aspects of self-regulation, students with metacognitive guidance group significantly better than students non-metacognitive guidance group.

CONCLUSION

The results showed that the average of students' self-regulation who received metacognitive guidance was in the medium category. From the data analysis, the self-regulation of the students which learn through metacognitive guidance was significantly better than the self-regulation of the students which learn throughscientific learning. It can be conclude that using metacognitive questions in mathematics classroom can give a contribution in developing students' self-regulation.

Recommendation

a. This research were limited in observation the students' self-regulation after learning mathematics in six meetings. Further research can be conducted in some more meeting times, so it also can observe the enhancement of students' self-regulation before and after learning mathematics using metacognitive guidance.
b. This research were use student worksheet as additional learning media in giving the metacognitive guidance when solving problems. For further research or implementation, other media an other learning design can be developed to optimizing the use of metacognitive guidance in mathematics classroom.

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DEVELOPMENT OF MATHEMATICS LEARNING EQUIPMENTS USED CYCLE-5E LEARNING MODEL TO IMPROVE STUDENTS' MATHEMATICAL COMMUNICATION SKILLS CLASS X STUDENT OF SENIOR HIGH SCHOOL

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Abstract

This research is motivated by the ability of students' mathematical communication skills is not achieved yet maximally. It is known from observation and analysis of the test results of students' mathematical communication skills. There are several factors causing low these capabilities, one of them is the unavailability of teaching materials that optimally facilitates students to grow and develop mathematical communication skills. The purpose of this study was to produce valid mathematical learning tools, practices and effective based on the model-5E learning cycle. This type of research is the development by using models Plomp which consists of three phases, namely the preliminary research, prototyping phase and the assessment phase. In the preliminary phase of research carried out a needs analysis, analysis of learners, curriculum analysis, concept analysis, and analysis of existing teaching materials. In development phase was done designing learning equipment with the learning cycle-5E model, and then conducted a formative evaluation to determine the validity of the three specialist mathematics education, educational technology experts and Indonesian experts. Practicality is known through the implementation of learning outcomes observation sheet, interview and questionnaire responses for students and teachers. The effectiveness of the learning equipment can be obtained from the analysis of the test results of learners' mathematical communication skill were calculated based on learners' individual mastery.

***Keywords**: Learning Cycle-5E, Development, Learning Equipments*

INTRODUCTION

Mathematical according to their characteristics as queen and maids science has a role to help people in developing science and technology. Based on such roles, math in education helps learners to find solutions to the problems that it faces. Therefore, students need to have the ability to manage information, the ability to think critically, systematically and logically. Such capabilities can be developed through a process of learning mathematics.

Mathematics learning process will take more purposeful if a teacher knows and understand the purpose of learning. The purpose of the fourth point of learning mathematics stated in the Ministerial Regulation Number 59, 2014 is to make students are able to communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem[1]. Thus, it is clear that the mathematical communication is one of the important capabilities that must be developed in students. Through mathematical communication skills, learners can organize and incorporate mathematical thinking both orally and in writing that they will provide students in-depth understanding of mathematical concepts have been studied. Baroody states there are two important reasons why the learning mathematics focuses on communication, that's mathematics as a language and mathematics learning as a social activity[2].

However, based on observations that have conducted in the classroom still tend to be dominated by the teacher. Learners are accustomed to receiving the teacher's explanation rather than trying to find a mathematical concept learned. It can also be known from Lesson Plan (RPP) created by teachers, where the presentation of activities performed by teachers while learners are only given the opportunity to ask. As the result, learners do not understand the concepts of the lessons. Incomprehension learners make the concept of mathematical communication ability of learners to be low. Lack of communication skills mathematical learners are caused by several things including learning process that teachers do not help learners understand the subject matter well, the students have not been given the opportunity to construct their own understanding of the material being studied, and the teachers did not facilitate learners to engage actively in asking and communicate ideas/ideas. So it can be said that the learning process did not facilitate learners to be active in learning.

The learning process like this is always a problem in the teaching and learning activities in schools, especially in learning mathematics. To maximize the learning process and results of mathematics, teachers should encourage students to get involved actively in discussions, learners need to be guided to be able to ask and answer questions, think critically, explains each answer given and filed a reason for each answer posed. Based on this, the mathematical communication skills need to be improved to get more attention. In order to optimize the communication skills of mathematical learners, teachers need to use models/methods that require activeness and cooperation of learners in the classroom. Besides, the using of teaching materials can also support the achievement of the objectives of learning so as to improve the communication skills of mathematical learners.

One of the teaching materials can be used by teachers in mathematics, namely Students Worksheet (LKPD). LKPD are teaching materials in which there are steps that can help to build the knowledge and directing learners construct their own knowledge and thinking ability. By issuing his ideas in oral and written communications are expected to hone mathematical learners well, so LKPD expected to assist and facilitate the teachers in implementing the learning and learners will be trained to learn independently and learn to understand an assignment in writing. LKPD can be a guide for students to discover concepts and build knowledge through the steps undertaken by learners. Such activities must be started by giving problems to make learners interested and these problems are issues that should be close to the daily learners. Furthermore, students are directed to look for solutions and problems solving by thinking itself. LKPD just directing what should be done by learners and not directly present the concept so that learners are able to construct their understanding and directly involved in the learning process.

Therefore, the implementation and results of learning by using learning tools and teaching materials such as LKPD expected to facilitate learners to be active in learning so that learning can run fun and in accordance with the expected goals. This can be done by teachers by designing an interesting activity and encourages learners to use the patterns of thought. One of them is by applying the learning cycle-5E model. This is a model of learning centered on the learner (student centered) and a series of phases of activities (phase) is organized such that the learner can master the competencies that must be achieved in learning with the active role[3]. This learning model is one learning model that fits the paradigm of constructivism. The learning with Constructivist approach basically emphasizes the importance of learners construct their own knowledge through involvement in the learning process. Beside to understand the knowledge learned also to develop the ability to convey information or communicate ideas. Therefore, learning with a constructivist approach can improve communication skills of learners that involve how to convey information or communicate ideas. So that the learning process is centered on the learner (student centered) than teacher centered. In other words, learning using learning cycle model centered on learners and teachers act as facilitators[4].

Initially a learning cycle-5E model consists of three stages: exploration, invention, and discovery. All of these stages are being turned into five stages by Lorsbach, they are (1) Generation of interest (engagement), (2) Exploration, (3) Explanation, (4) Elaboration, and (5) Evaluation. The stages of learning model learning cycle-5E according Lorsbach described below: (1) engagement, at this stage the teacher tried to get up and develop the interest and curiosity of students toward the material to be studied to provide questions that stimulates prior knowledge of learners, storytelling, demonstrations, and view pictures or video; (2) exploration, the exploration stage formed small groups about 2-4 people, and then given the opportunity for learners to observe, record data, isolate variables, create charts, analyze results, develop hypotheses, and organize their findings; (3) explanation, this stage is the stage of classical discussion where students present concept of the findings of the group with their own words, evidence and clarification of their explanations, as well as comparing the arguments they have with the arguments of other students; (4) elaboration, in this step the students apply the concepts they get to solve the problems solving; (5) evaluation, this phase is used to assess the level of understanding after learning that has been done, for example by providing an open question and giving a test (quiz) [5]. Based on these stages, the election of learning cycle-5E models can be used as an alternative so that learners are able to construct knowledge or concept independently so that mathematical communication skills of learners can be achieved optimally.

The application of the learning cycle-5E model can run optimally if the teacher is also designing and using additional teaching materials, namely LKPD. LKPD designed with a learning cycle-5E loading work steps that can be used in constructing an understanding of learners so that learners can find the concept of the material being studied. In order LKPD development can be implemented with a more practical and effective, the researcher also developed a lesson plan that includes a series of learning activities with a learning cycle-5E model.

Based on the explanations above, the researchers will conduct research on the development of learning tools such as lesson plans and models LKPD with learning cycle-5E model. Formulation of the problem in this research is how the process and results of development of learning model with learning cycle-5E model to improve mathematical communication skills of class X SMA that is valid, practical, and effective. Based on the formulation of the problem that has been presented, the purpose that will be achieved in this research is to know the process and outcomes of learning tools development with learning cycle-5E model to improve mathematical communication skills of class X SMA that's valid, practical, and effective.

RESEARCH METHODS

This type of this research is the development research using Plomp models, ranging from the initial investigation phase (preliminary research), phase of development (prototyping stage) and assessment phase[6]. Phase of preliminary investigations (preliminary research) consists of requirements analysis, analysis of learners, curriculum analysis, and analysis of the concept. Needs analysis is conducted by observation, interview and test of mathematical communication skills. The collection of information is done by observing the learning activities in the classroom and interviewed some of the students and teachers, and observes the learning tools used in the schools. Information obtained to analyze the characteristics of learners obtained from the questionnaire, which the characteristics of LKPD desired by the learners seen from the paper size, preferred color and the illustrations.

In the analysis phase conducted the study toward KTSP curriculum for mathematics courses in high school. This analysis aims to look at the range of material, learning objectives, and selection of appropriate strategies as the basis for developing a learning tool is expected. This indicators analysis such as the determination of materials for class X SMA even semester that will be developed its learning tool. The elaboration of standard competencies (SK), basic competence (KD) and indicators of achievement of competencies are consideration to determine the necessary concepts in mathematics learning and measure achievement of SK and KD. Based on the elaboration of SK, KD and indicators will be compiled learning tools of mathematics with learning cycle-5E model in the form of RPP and LKPD.

Concept analysis is the identification of materials that will be discussed on learning. These materials were systematically arranged by associating one concept to another relevant so as to form a concept. This analysis aims to determine the content and subject matter that can be served at LKPD with learning cycle-5E model.

RESULTS AND DISCUSSION

Needs Analysis carried out by gathering information done by interviewing 2 math teachers class X SMAN 4 Solok Selatan and SMAN 5 Solok Selatan. Based on observations and interviews with Math teachers, the needs of learners towards new learning model better able to optimize learners' mathematical communication skills. Based on the results of initial tests of mathematical communication skills of learners, it is concluded that the learners' mathematical communication skills is still not optimal yet. Learning with learning cycle-5E model selected as an intervention because based on the theory of constructivism approach learning cycle-5E models can help learners to improve mathematical communication skills.

Based on the results of the interview will also be concluded that the material chosen for this development is a matter of trigonometry and three-dimensional space because this material is a material that is quite difficult to grasp learners and the materials will always be found by the learners until getting National Examination (UN). Another requirement in implementing learning is learning tool. The learning tools such lesson plan (RPP) and Worksheet Students (LKPD) which is able to improve the learners' mathematical communication skills at class X of Senior High School in trigonometry and Space of Three Dimensions materials.

In the curriculum analysis phase conducted the study toward KTSP curriculum for mathematics courses at class X senior high school. This analysis is the determination of indicators of Trigonometry and Space Three Dimension material second semester that will be developed its learning tools. The elaboration of SK, KD and indicators of achievement of competencies are consideration to determine the necessary concepts in mathematics learning and measure achievement of SK and KD. The concept analysis carried out on the Trigonometry and Three Dimensional Space materials, those are the concepts what should be studied by the learners based on SK and KD that have been there.

CONCLUSION

This research is a development research to create learning tools with learning cycle-5E model in form of lesson plan (RPP) and LKPD. The research that will be conducted on the process of developing of learning tools with the learning cycle-5E model at tenth grade students of Senior High School, conducted by Plomp development model consisting of three phases which consists of investigation, the development phase and the assessment phase. In the preliminary phase carried out a needs analysis, analysis of learners, curriculum analysis, and concept analysis as the basic of a learning tool development. The result on the needs analysis is tool characteristics that desired is learning tools with the learning cycle-5E model in the form of RPP and LKPD. Curriculum analysis aims to adjust the relationship between concepts and see the basic competencies that can use the learning cycle-5E model. The results of the concept analysis are learning materials that needed in development so indicators of competence achievement can be achieved.

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DEVELOPMENT OF MATHEMATICAL LEARNING EQUIPMENTS BASED ON APOS MENTAL CONSTRUCTION TO IMPROVE STUDENT'S MATHEMATICAL COMMUNICATION ABILITY FOR JUNIOR HIGH SCHOOL GRADE VII

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Abstract

Mathematical communication ability enable students to be able to communicate concept or mathematical ideas with symbols, tables, diagrams, or other media to clarify the situation or problems and discuss them with others. Based on the observation and analysis of the test results of students' mathematical communication abilitys, it is known that the students' mathematical communication abilitys are still low. To diminish this problem, then is developed mathematical learning equipments based on APOS mental construction. The purpose of this research is to develop learning equipments to fulfill valid criteria, practical and effective. Learning equipments consist of Lesson Plan and Students' worksheet. This research used Plom development model consists of three stages: preliminary research, development or prototyping phase and assessment phase. In the preliminary stages of research, the researcher conducted a needs analysis, curriculum analysis, analysis of students and analysis concepts. At the development stage or prototyping phase is designed lesson plan and students' worksheet based on APOS mental construction. Then is self evaluation and validation by experts. In the assessment phase to test the practicality and effectiveness of the test. The practical data obtained from learning Keterlaksaan observation sheet, interviews, and practical questionnaire for teachers and students. Meanwhile, the effective data obtained from the final test mathematical communication ability of students.

Keywords: APOS mental construction, mathematical communication ability, learning equipments

INTRODUCTION

Math is one of the lessons taught in school. Math can equip the students with the ability to think logically, analytical, systematic , critical and creative . Through mathematical thinking skills students are expected to be able to evolve so that it can resolve and communicate problems in everyday life.

Given the importance of mathematics, the definition and purpose of mathematics education in the classroom should be adjusted to the demands of changing times. By knowing and understanding the learning objectives, the learning process will take a more focused. This is done so that students learn to digest new ideas, able to adapt to changes, capable of handling uncertainty, were able to find order and able to solve problems that are not uncommon . In the appendix Permendikbud No. 58 2014 on content standards, mentioned that the aim of mathematics given one of which is intended to make students able to communicate ideas, reasoning and able to devise mathematical proofs using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem.

Based on observations on some of the Junior High School, it was found that students have difficulty in solving the form of a story. Studentscan not write processes are carried out cascading. The lack of activity of students in communicating his opinion adversely affects the students mathematics communication ability.

A mathematical communication ability of students to express and interpret mathematical ideas orally, in writing or demonstrating what is in mathematical problem [1]. It means that students are required to skilled at communicating its ideas.
Implementation of learning to improve communication ability of mathematics can be supported by the availability of teaching equipments. The guides were used students to understand the acquisition of information compiled in the form of learning Students Worksheet. students worksheet typically contains a sheet that contains study equipments arranged in a systematic and orderly. Through students worksheet, teachers can direct the activities that should be undertaken by students. Students worksheet drafting is done by considering the characteristics, equipmentss and cognitive ability of students.
In order to build a concept in the mind of the student is required to construct a theory of knowledge. One of mental constructs theory that can be used to assist students in constructing knowledge is a mental construction theory APOS (action-process-object-schema) developed by Dubinsky and colleagues [2]. APOS theory adopts social konsruktivisme developed by Vygotsky, namely social constructivism. Knowledge and understanding of mathematical owned students is the result of construction and their interaction with others in understanding of mathematical ideas and results of mental constructions that person to understand mathematical ideas (Dubinsky & Mc. Donald, 2001). As research conducted by Muchtar with a study entitled "Application of Learning Model Modification-Action, Process, Object and Schema (M-APOS) to Improve Ability Students Understanding of Mathematical Concepts". This study obtained results that increase the ability of understanding mathematical concepts students who follow M-APOS learning is higher than on the ability of understanding mathematical concepts students who followed the conventional study [3].
Based on the above, the researchers will conduct research on the development of learning equipment such as lesson plans and students worksheet based of APOS mental construction. Learning equipment that will be developed in this study refers to the APOS mental construction. Formulation of the problem in this research is how the device characteristics based math learning APOS mental constructs that can improve mathematical communication ability for junior high school grade VII are valid and practical? And What is the effectiveness of mathematical learning equipments based on APOS mental construction to increase student's mathematical communication ability for junior high school grade VII?. Based on the formulation of the problem that has been presented, the goals to be achieved in this study was to determine the characteristics of the mathematics-based mental constructs APOS to improve communication ability of mathematics students class VII valid and practical and to know a the effectiveness of the lesson plain and students worksheet based APOS at enhancing mental constructs mathematical communication ability of students class VII.

RESEARCH METHODS

This type of research is a research and development. Mental constructions based learning equipment developed by APOS development model adapted from the model Plomp. Plomp Model consists of three stages, they are preliminary research, development or prototyping phase, assessment phase [4]. In preliminary research conducted a needs analysis, curriculum analysis, analysis of students, and analysis concepts.
At the stage of information gathering needs analysis conducted by observing and interviewing some of the students and teachers, and observe the learning device used in the schools.
Curriculum analysis is done by examining the curriculum used in pilot schools. Analysis of the curriculum focused on the analysis of Competency Standards and the Basic Competency. In this analysis examined Competency Standards and Basic Competency relating to the equipments to be studied students during several meetings.

This analysis was conducted to examine the character of students to be taken into consideration in designing devices based learning mental construction APOS include cognitive level, age, learning styles and motivation of the subjects.
Analysis of the concept is the identification of the main concepts that will be studied by students and systematically arranged in the order they are presented. Analysis of the concept also aims to identify the facts, concepts, principles and procedures that must be mastered students.

RESULTS

Based on the needs analysis obtained information that the lesson plain and students worksheet who have no need to be improved in order to better engage students actively. In order for the lesson plain and students worksheet can help teachers and students in the learning and learning outcomes of students can be obtained with the maximum. In addition students worksheet need contains instructions that will guide students to understand the lesson.
Anaisis based curriculum, it is known that there are four items in the second semester is set, lines and angles, triangles and rectangles. The topic was taken to the development of devices in this study is a rectangular equipments. The topic chosen because it is close enough equipments to students' lives as well as the widely used next. In addition, this topic is quite difficult to understand by students.
At the stage of concept analysis carried out activities to identify, specify, and systematically compile the main topics that will be studied by students. The topics are arranged hierarchically. Its main topic is flat wake rectangular sub topic are properties Flat rectangular, flat wake circumference and area of the rectangle.
Based on analysis of students can be knotted that students not been actively involved in learning. Many students who have not followed the learning to the maximum, it is marked with the number of students who carry out other activities apart from learning activities. Students also found that learning implemented yet provide opportunities for students to be actively involved. Additional information is obtained students have used students worksheet, but the students worksheet not help students to understand the lessons optimally. The lesson in students worksheet presented directly and proceed with the exercise. According to the students to see students worksheet also not attractive that needs to vary and students also want colour full students worksheet.

CONCLUSION

This research is the development, the development is a learning tool that is a Lesson Plan and Worksheet Students. This study uses a model of development Plomp. Based on the results of the preliminary analysis, it will be developed mathematical learning equipment based on APOS mental construction in order to improve student’s mathematical communication ability.Learning equipment that will be developed on the topic rectangular flat wake.Students worksheet that will be developed will be designed to promote the spirit colored students learn some vital lessons.

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PRELIMINARY STAGE OF THE DEVELOPMENT OF MATH PROBLEMS WHICH REFER TO PISA

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Abstract

The results of the OECD study on Indonesia students' mathematical literacy in 2013 showed a decrease of the study results in 2009. This decrease was due to students not accustomed to resolve the problems requiring mathematical literacy skills. In addition, teachers are less familiar with the problems in PISA also be a factor why the students can't solve problems that require mathematical literacy skills. To solve the problem, one of the efforts that can be done to overcome these problems is to develop mathematical problems which refers to PISA. The type of this research is development research by using Plomp model. It consists of preliminary research, development phase and assessment phase. In preliminary research, researcher conducted analysis of student, curriculum analysis, and literature study. In the phase of development or prototyping to design a math problem that refers to the standard PISA. At this stage applied formative evaluation to determine the validity of the product. In the assessment phase carried out an assessment to see how the problem solving skill and representation skill of students to solve mathematical problems which refers to PISA. The study will be conducted in three secondary schools in Padang Panjang that have high, medium and low level ability. From these results will be obtained valid math problems that refer to PISA and obtained data to describe how the problem solving skill and representation skill in solving mathematical problems which refers to PISA.

Keyword *: Programme for International Student Assessment (PISA), problem solving ability, representation ability*

INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, have an important role in a variety of disciplines and develop the power of human thought. The rapid development in the field of information and communication technology today is based on the mathematical developments in the field of number theory, algebra, analysis, probability theory and discrete matenatika. To master and create the future technology required a strong mastery of math from an early.(Sinta:2012)

In the era of globalization, students in Indonesia should be able to compete with other students in different countries. Several types of tests are conducted internationally can be used as a benchmark to determine the extent to which our students are able to compete in the era of globalization.

Indonesia's involvement in the Program for International Student Assessment (PISA) is an attempt to see how far our education programs in developing countries compared to other countries in the world. This becomes very important from the interests of our children in the future to come so as to compete with other countries in the era of globalization.

PISA is the study of international student assessment programs organized by the OECD or the organization for Economic Cooperation and Development, based in Paris, France. The PISA aims to examine periodically on the ability of students aged 15 in reading (reading literacy), mathematics literacy (mathematics literacy), and science (scientific literacy). PISA measures the ability of the students at the end of compulsory school age to determine a student's readiness to face the challenges of the knowledge society (knowledge society) today. Assessment conducted in PISA oriented towards the future, ie testing the ability of young people to use their skills and knowledge in facing the challenges of real life, not merely measure the capabilities included in the school curriculum.

Problems in the PISA tests emphasize to the literacy skills of students. In the PISA mathematics is not only seen as a discipline of science, but how students can apply the knowledge in a real-world problem or everyday life so that knowledge is beneficial directly to students. Someone said to have a good level of literacy if he is able to analyze, reason and communicate mathematical knowledge and skills to effectively and be able to solve mathematical problems and interpret settlement. Therefore, each question contains the PISA mathematical literacy among 1. formulating situations mathematically, 2 to apply concepts, facts, procedures and mathematical reasoning, 3. Interpret, use and evaluate math (OECD: 2010). According to Lange (2006) competencies that will shape literacy mathematical namely 1) the competence of thinking and reasoning mathematically, 2) competence argue logically, 3) the competence to communicate mathematically, 4) competences in modeling, 5) competence propose and solve problems , 6) the competence to represent ideas and 7) the competence to use symbols and formal language. Interest in mathematics PISA is to measure the level of students' skills in using mathematical knowledge and skills in dealing with everyday life. It is almost similar to the purpose of learning mathematics in school.

The purpose is to create a mathematical pemebelajaran individuals who are not only skilled in using basic math skills but also able to apply or utilize those skills in solving problems in everyday life. Therefore, it is expected in the learning of mathematics teachers to at least introduce to students PISA questions so that students can practice using their math skills in resolving problems in the matter and teachers also used to present the contextual issues such as the problems of PISA.

PISA study is held every three years, namely in 2000, 2003, 2006, 2009, and was last held in 2012. In 2000 PISA study focused on the ability to read, while the other two aspects of a companion. In 2003 the mathematical aspects be the main focus, and then forwarded aspects of IPA in 2006 (Bahr: 2010). Meanwhile in 2012 the three are a major concern.

Achievement of Indonesia in 2003 was ranked 38th out of 40 countries, in 2006 was ranked 53 out of 57 countries, in 2009 Indonesia was ranked 61 out of 65 countries. The latest PISA survey results of 2012 released by the OECD in early December 2013 showed mathematical ability students Indonesia ranks 64 of 65 countries with a score of 375.

From these results it can be seen only a small part of Indonesian students who were able to solve the problems at level 5 or 6 and more students are only able to solve problems in level 2 downwards. Based on these data can also be seen that the ability to read and the science is still in the low category. It is indirectly also affect the ability of students in mathematics literacy.

The result could be a setback due to the learning of mathematics which still emphasizes the mastery of basic skills, but very little emphasis on the application of mathematics in the context of everyday life, communicating mathematically, and to reason mathematically. Meanwhile, questions PISA very demanding their reasoning skills, mathematical thinking and problem solving in resolving the problem. According to Ward, a student said to be able to resolve the problem if he can apply the knowledge that has been acquired prior to the new situation that has not been known. Besides Indonesia causes of low achievement in the PISA survey is not a matter of familiarity of students with PISA models.

To improve these conditions, teachers should familiarize students with problems can improve students' skills in math berliterasi. But in realizing it encountered many obstacles. Among these constraints are still many teachers who are not familiar with the problems of PISA. This resulted in students also unfamiliar or even not at all familiar with the problems PISA. It is also supported by interviews with some of the junior high school teacher writers in Padang Panjang on October 23, 2015. From the interviews it is known that the teachers did not know about the problems of PISA. When asked about the contest literacy math teacher thought that it was the same as when the Olympic Math Olympiad is different with mathematical literacy contest. In mathematical literacy contest questions usually tested are math standard refers to PISA. This resulted in teachers' lack of knowledge about the mathematical literacy. Besides the availability of support resources that can be used by teachers as a guide in order to increase knowledge and to train students in berliterasi also limited. This has implications for not familiar with the matter PISA students so that students only familiar with the problems that are stressed on the basic skills without problems coupled with the application of mathematics in everyday life.

The interview results are also supported by the fact when the author tries to give an example of one of the PISA questions to the teacher. It turned out that the teacher does not think that the questions presented is one of the PISA questions used to measure mathematical literacy skills. Sample questions given as in Figure 1 below.

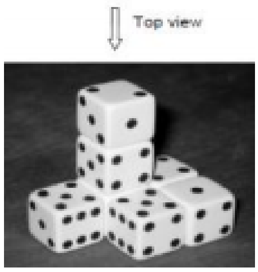

Figure 1. example PISA question

In the picture above arrangement dice made of 7 identical dice that have eyes 1 to 6. When the arrangement is viewed from above, just five dice that can be seen. What is the number on the dice that can be seen when the composition of dice viewed from above?

Things almost similar sentiment was also expressed by the results of research conducted by Fauzan (2013). Results of the study revealed that in general teachers do not have a good knowledge about PISA, mathematical literacy, and mathematical abilities. This is a direct impact on their ability to devise questions for assessing literacy and mathematical abilities of students. As a result, teachers rarely introducing students to shape the literacy issues that the students will become familiar with the questions that test their mathematical abilities so that it becomes one of the factors that make students berliterasi in Indonesia in the international arena is still low.

In order to overcome these problems need their available supporting material or references that can be used by teachers as a reference so that the math problems are given to students in mathematics learning emphasizes not only basic capabilities, but also questions the application so siswapun familiar with other forms of math which refers to the standard PISA. With terbiasanya students in working on the problems it is expected to improve Indonesian students PISA test results for the next period.

Based on the explanation above, the writer wants to do research Developing Mathematical Problems Which Refers to PISA.

This study will begin by analyzing the student, curriculum analysis and study of the literature regarding the characteristic problems of PISA and then will be prototyping stage is aimed at generating mathematical problems based on standards PISA then validate and test products to generate mathematical problems based on standards PISA valid and practical.

METHODOLOGY

This type of research is the development of research using a model Plomp which consists of three phases: preliminary research, prototyping stage and assessment phase. In the preliminary stages of research analyzed the students, analysis of curriculum that aims see any material students learned, then study literature about the issues PISA. At the stage of prototyping stage to do the product creation process by adopting the formative evaluation tesmer. Figure groove tersmer evaluation can be seen in the following figure:

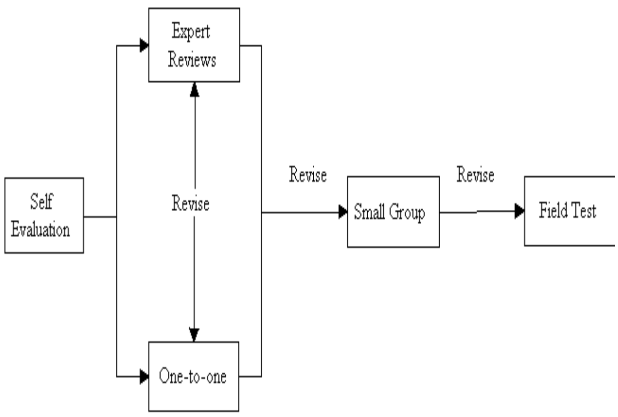

Figure 2. Formative Evaluation Flow by Tesmer

After prototyping stage next step is the assessment phase.

The subject test adalam were students of class IX SMP / MTs in Padang Panjang and the sample were students of class IX MTsN Padang Panjang, a class IX student of SMPN 1 Padang Panjang and IX grade students of SMP Muhammadiyah Padang Panjang. The sample selection is based on the average value of the UN in the previous year.

To collect the data used several instruments collecting data such as interview guides, observation sheets, field notes and questionnaires. Guidelines interviews and field notes used when a preliminary analysis to determine how the students' characteristics, materials any student has learned and the context of what is close to the students. Results of interviews and field notes will be used as a guide in designing mathematical problems based on standards developed PISA wanting. Once the matter is finished then problems developed is validated to the experts to obtain the fix .For it is used sheets of validation addressed to the experts.

Furthermore, at the time of the trial used a questionnaire about ditjukan to students that aims to see whether the questions that have been made easier to understand the students in terms of language and context matter close to the students' everyday.To view the validity of each item about the calculation by using the correlation Spearmann Brown.

RESULTS AND DISCUSSION

Preliminary analysis was conducted by interviewing beberpa teachers from different schools. Interviews were conducted with one of the math teacher in SMPN 1 and one Mathematics teacher in MTsN Padang Panjang. From interviews obtained information that they still lack the contextual issues that stimulate students' mathematical thinking ability in solving mathematical problems. In general, given the problems are more fundamental concepts about the nature without the application of these concepts in everyday life. It affected by limited referral teachers in presenting the contextual issues in students. From the results of this preliminary analysis also obtained information that students tend to be more interested in context with their lives and they are familiar with such as ketupat pitalah sate mak syukur, gunung marapi and others.

After an initial interview and then conducted a study of literature about the issues PISA. Then devise questions that refer to the PISA standards with reference to information obtained from a preliminary analysis.

CONCLUSION

This research is a development that aims to develop a mathematical problem which refers to the PISA standards to the local context Padang Panjang. Results of a preliminary analysis indicates that there is very rarely give teachers the problems are applications in everyday life so that students are not familiar and less honed his ability to resolve problems is the application. In addition, these results obtained from the information that students tend sukadengan context that is close to them such as ketupat pitalah sate mak syukur, and gunung marapi.

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PRELIMINARY RESEARCH ON DEVELOPING MATHEMATICAL MATERIAL WITH RME APPROACH FOR IMPROVING MATHEMATICAL LITERACY ABILITY OF JUNIOR HIGH SCHOOL STUDENTS ON GRADE VIII

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Abstrak

This study originated from low mathematical literacy skills of students. This can be seen from the test results of mathematical literacy students in West Sumatra in 2012 which was held by Universitas Negeri Padang,but it is also seen from the observations and interviews with teachers. One way to overcome this problem is developing mathematics learning instruments based on Realistic Mathematics Education (RME). In this research, learning instruments meaned are lesson plans and students worksheets based on RME. The purpose of this research is to produce mathematics learning instruments that valid, practice and effective. This type of research is research development by using Plomp model that consist of preliminary research, development or prototyping phase and assessment phase. The preliminary research aims to investigate needs analysis, curriculum analysis,analysis of students, and analysis of related concepts in mathematics. The development phase aims to design lesson plans or Rencana Pelaksanaan Pembelajaran (RPP) and student worksheets or Lembar Kerja Peserta Didik (LKPD) based on RME on material comparison and opportunities, then conducted self evaluation and experts review. In assessment phase conducted practicality and effectiveness test. Practicality was seen through the results of the observation sheets of learning implementation analysis and questionnaire responses for students and teacher. Effectiveness was seen through the results of mathematical literacy test.

Keywords: *Realistic Mathematics Education*, *Development, Learning Tools*, *Mathematical Literacy*

INTRODUCTION

Mathematics is a prayer One thing NOT Sciences Branch can be separated from the Life of Man, BECAUSE mathematics Growing And Growing as a Human ACTIVITIES The shaping of Paradigms of Human hearts Certain fields, trained berkomunikasi, critical thinking, logical and sistematis.Menurut Permendiknas Number 58 Year 2014 , There is a math lesson course goals Understanding the concept of mathematics; Using as an alleged pattern of hearts Troubleshooting, And Able MAKE OR generalization based on the phenomenon Data ADA; Using reasoning ON properties, perform mathematical manipulation; Communicate ideas, reasoning And Able to develop mathematical evidence WITH using complete sentences, symbols, tables, charts, media OR lying clarify to review the state of OR problems; Having ATTITUDE appreciate the usefulness of mathematics hearts of Life; Had Attitude And Behavior In accordance WITH Values hearts and learning mathematics; The motor perform activities using mathematical knowledge and using simple props and Technology to review the findings do math activities [1].

Based on the objectives of mathematics lesson in the differences can be concluded that learning mathematics Must accommodate standard ASPECT eighth helpful And Process For Everyday Life. The principle of the usefulness of hearts eyes of mathematics Lesson

Should early accommodated WITH How to integrate the issue of Everyday Life, natural phenomena well as a social phenomenon in the hearts of activities pembelajaran.Masalah differences can Judging hearts A pattern of ratings (ASSESSMENT) The so-called WITH mathematical literacy. Also called the mathematical literacy WITH mathematical literacy. BECAUSE important mathematical literacy mathematical literacy is the ability Someone hearts resolve an issue they have encountered, and Subscription WITH Employment and duties hearts everyday life [2] .Literasi mathematics is the ability of individuals to review Someone formulate, checklists Verifying, and interpret different mathematical hearts context, including the ability to perform mathematical reasoning Operates And using concept, procedure, Facts, and mathematical tools to review describes, explains the phenomenon estimates OR / Genesis [3] .At the time of modren Singer, mathematical literacy NOT Just as understanding Arithmetic, BUT Also Requires literacy HAL hearts mathematical reasoning and mathematical problem solving, BECAUSE Yang bagitu Many problems faced. Importance of mathematical literacy, yet consistent Turns WITH THE Learners Achievement mathematical literacy contest held UNP Year 2012.Fenomena The singer is reinforced by the findings of mathematical literacy skills test Junior high school students in West Sumatra in 2012 Yang was held by Universitas Negeri Padang.

Table 1. Total Score mathematical literacy students SMP / MTs in West Sumatra in 2012

No	Skor	Kelompok	Jumlah siswa	%
1	1 – 25	Rendah	76	40,43
2	26 – 50	Sedang	99	52,66
3	51 – 75	Tinggi	13	6,91
Jumlah Siswa			188	

Scores ideal mathematical literacy is 75. Based on Table 1, the scores students' mathematical literacy is still not optimal. Mathematical literacy scores of students at low and medium category is 93.09%, while for the higher category only 6.91% [3].

Low ability students' mathematical literacy, it requires a LKPD that can lead students understand mathematical concepts through a real problem. Realistic Mathematics Education (RME) is used to generate LKPD to make students understand the math concepts through real problems or real in the minds of students. RMEatau Indonesian Realistic Mathematics Education (PMRI) is a learning approach that starts from the real things or experienced students, emphasizing the process skills, discuss and collaborate, argue with classmates. RME is a learning approach that emphasizes math student activity in the learning process in the classroom with the aim that students are able to build his own knowledge of the mathematical problems being faced.

To implement the RME approach in the learning process of learning mathematics device is required. Learning tools that will be developed is LKPD. Because LKPD very possible to steer students understand mathematical concepts through learning-based RME. This learning will equip students to face everyday problems. LKPD good in mathematics will give opportunity to the widest students to develop their creativity in solving a problem. In order LKPD developed can be implemented with a more practical and effective, the researchers also developed a lesson plan that includes a series of activities based learning RME. Researchers chose the development of RPP RPP as a guide or guides the implementation of a learning process that will determine the actions of teachers and students in achieving the learning objectives have been determined.

Based on the above, the researchers will conduct research on the development of learning tools such as lesson plans and LKPD-based RME. RPP to be compiled in the research that will be done is the RPP refers to the principles and characteristics of RME. Formulation of the problem in this research is how the software development processes and outcomes-based learning RME to improve mathematical literacy skills class VIII SMP valid, practical, and effective ?. Based on the formulation of the problem that has been presented, the objectives to be achieved in this research is to know the process and outcome-based learning software development RME to improve mathematical literacy skills class VIII SMP valid, practical, and effective

RESEARCH METHODS

This type of research is the development of research using Plomp models, ranging from the initial investigation phase (preliminary research), phase of development or prototyping (prototyping stage) and assessment phase (assessment stage) [4]. Phase of preliminary investigations (preliminary research) consist of a needs analysis, curriculum analysis, analysis of the concept and ansalisis siswa.Analisis needs implemented by way of observation, and interviewed teachers at school. The purpose of needs analysis was to determine the basic problems that required in the development of learning tools. Needs analysis phase is done through the collection of information. Information obtained from interviews with teachers about the learning process that took place over the years, both from the aspect achieved or whether learning objectives have been set out in the curriculum, the learning activities in the classroom, and the use of learning tools such as LKPD and materials that are considered difficult. Information obtained from the student questionnaire form LKPD characteristics such as paper size is desired, the preferred color and the illustrations.

In the analysis phase of the study conducted curriculum Curriculum 2013 in the subjects of mathematics class VIII SMP. This analysis is necessary to study the range of material, learning objectives. This analysis indicators such as the determination of material Comparison and Opportunity class VIII SMP second semester will be developed learning tools. Translation of KI, KD and indicators of achievement of competencies into consideration to determine the necessary concepts in mathematics learning and measure achievement of KI and KD. KI and KD analysis of the results contained in the content standards are translated into indicators of achievement of competencies. Based on the translation of KI, KD and indicators this will then compiled based math learning tool RME in Comparative material and Opportunities in the form of RPP and LKPD.

Analysis of the concept is the identification of materials that will be discussed on learning. These materials were systematically arranged by associating one concept to another relevant so as to form a concept. This analysis aims to determine the content and subject matter that may be presented to the student RME.Analisis based LKPD done by gathering information through questionnaires.

Analysis of students examines the characteristics of students include: age, motivation of the subjects, academic ability, psychomotor and level of maturity. Behavior and characteristics of the students is very necessary to know the quality of individuals that can be used as guidance in lesson planning. The analysis conducted here is LKPD like what is needed by the student, include: Are learners want LKPD in learning, the preferred color, size LKPD desired, whether in the LKPD learners prefer LKPD contain images or animations.

RESULTS AND DISCUSSION

Needs Analysis carried out by the information gathering done by interview some teachers of mathematics and observation. Based on observations, it appears that students' difficulties in solving mathematical problems. This was seen when the teacher asked students to answer the questions that require analysis or because such a matter of application, they are difficult to resolve the matter. Based on interviews conducted with teachers, also found that teachers find it difficult to provide analysis about the nature and the matter of applications to the students, because students are familiar with problems that can be directly answered by the students. In order for students' mathematical literacy is more optimal, then one alternative is to provide a learning device that can support the achievement of the desired learning process. Learning tools are provided in the learning process is the RPP and LKPD. LKPD is one of the teaching materials that really support the learning process. LKPD that there did not facilitate students in optimizing the mathematical literacy skills, so it is not optimal mathematical literacy skills of students. Therefore, one way to do that is by developing a device based learning RME.

In the analysis phase of the study conducted curriculum Curriculum 2013 2So half of the subjects of mathematics class VIII SMP. Curriculum analysis is done by examining the curriculum used in the school curriculum 2013 trial that the semester 2. Based Permendiknas 58 In 2014, results of the analysis of the curriculum is focused on the analysis of KI and KD. In this analysis assessed KI and KD relating to the material comparisons and opportunities that will be studied learners during several meetings. The material chosen is a comparison and peluangkarena such material is very closely related to the daily life of students. Based on the description above, in order to achieve KI and KD are then drafted indicators are written in the RPP learning and as a reference in making learning device. Indicators are used as a reference to create learning objectives for each meeting, where in one indicator can be used to achieve one or more learning objectives.

Analysis of the concept aims to determine the content and subject matter that is needed in the development of learning tools.

In the analysis phase the student, be giving questionnaires to learners. Based on questionnaires given to students seen that learners prefer to learn by using LKPD as more attractive. Learners prefer LKPD using pictures and animations. Additional information obtained from the questionnaire is the dominant color preferred by learners are blue and red. As for LKPD desired size is A4 sized learners.

CONCLUSION

This research is aimed at generating a development-based learning tools such as lesson plans and LKPD RME. Research will be conducted on the software development process based learning RME class VIII SMP on material comparisons and opportunities in the form of RPP and LKPD implemented Plomp development model consisting of three phases which initial investigation, the development phase and the assessment phase. In the preliminary phase carried out a needs analysis, curriculum analysis, analysis of the concept and analysis of the students as the basis for software development pembelajaran.Hasil on a needs analysis form the desired characteristics of the learning device is a device-based learning in the form of RPP and LKPD RME. Analysis curriculum aims to adjust the relationship between concepts and see the basic competencies that must be achieved learners. The results of the analysis of the concept in the form of the order of subject matter that is needed in the development that can be achieved competence achievement indicator.

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DEVELOPMENT TOOL LEARNING CONTEXTUAL BASED COMMUNICATION MATHEMATICAL ABILITY TO INCREASE IN CLASS VIII SMP

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Abstrak

This study originated from low mathematics achievement of terms of mathematical communication skills. This can be seen from the observation and analysis of the test results of students' mathematical communication skills. One way to overcome this problem is developing mathematics learning instruments based on contextual approach. In this research, learning instruments meaned are lesson plans and students worksheets based on contextual approach. The purpose of this research is to produce mathematics learning instruments that valid, practice and effective. This type of research is research development by using Plomp model that consist of preliminary research, development or prototyping phase and assessment phase. In the preliminary research, researcher carried out a needs analysis, curriculum analysis, analysis of concept and analysis characteristics of students. The development or prototyping phase, researcher design lesson plans or Rencana Pelaksanaan Pembelajaran (RPP) and student worksheets or Lembar Kerja Peserta Didik (LKPD) based on contextual approach on material geometry. The learning instruments validated by three mathematics education experts, an education technology expert and an Indonesian language expert. In assessment phase conducted practicality and effectiveness test. Practicality was seen through the results of the observation sheets of learning implementation analysis, and questionnaire responses for students and teacher. Effectiveness was seen from the final test of students' mathematical communication skills.
Keywords: Contextual Approach, Development, Learning Tools

INTRODUCTION

Mathematics is learning that there are at every level of primary and secondary education for mathematics became the basis for other sciences. Mathematics is the calculation of numbers that can not be separated from everyday human life. Mathematics is also the basic science that really cultivate students' brains. Mastering mathematics learning with real good student will have a distinct advantage compared to students who do not understand the math, that indirectly students have been labeled as a smart student.

The main target of learning is not only to understand and master the concepts, but students are required to be able to associate the application of learning materials to students' daily lives. Math can shape students' thinking, to learn math students are expected to think logically, critically, systematically understand an understanding and are able to communicate ideas.

Learning is a process of interaction between students and the environment, resulting in a change of behavior towards a better (Mulyasa, 2002: 100). In the study, the main task of the teacher is to condition the environment to support a change in behavior, knowledge, skills and understanding. Conditioning of the learning environment should include the purpose of teaching is based curriculum.

One of the goals of mathematics learning in Indonesia contained in the Minister of Education and Culture of the Republic of Indonesia Number 58 of 2014, there is a purpose of mathematics courses is as follows

1. Communicate ideas, reasoning and able to devise mathematical proofs using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem.
2. Have respect for the usefulness of mathematics in life, are curious, attention, and interest in studying mathematics, as well as a tenacious attitude and in solving problems.

Two purpose of learning mathematics by Permendiknas above put their communication skills and attitudes appreciate the usefulness of mathematics in life. Students are said to have the communication skills if students are able to construct meanings in teaching such as oral communication, writing and graphics.

Mathematical communication skills by Dawn (2009: 13) were the students able to express and interpret mathematical ideas orally, in writing or demonstrating. The process of communication can take place between teachers and students, between the book with students, and between students and students. According to the NCTM (Eka Kasah Gordah, 2013) indicator of the ability of students in mathematical communication in mathematics can be seen from:

a. The ability to express mathematical ideas through oral, written, and visually demonstrate and describe it;

b. The ability to understand, interpret, and evaluate mathematical ideas both orally and in other visual forms;

c. The ability to use terms, notations of mathematics and its structures to present ideas, describe the relationships and models of the situation.

Learning math will give good results if the purpose of learning mathematics can be met. However, based on the observation that communication skills are still low. Low mathematical communication skills of students in some schools, namely in SMPN 2 district. Mungka and SMPN 3 district. Guguak due to the lack of interaction between teachers and students, students are reluctant to ask if there is still poorly understood, so that students are less able to construct mathematical problems in the form of a story into a mathematical model that formulas that could be used. This is because students do not understand the meaning of symbols in mathematics. Learning has been more emphasis on the provision of the formula, example problems and discussions of routine so that students receive only a concept and then students tend to memorize more than understand the mathematics. If given a somewhat different matter, students can not be resolving to the maximum. When administered in the form of questions about the story, the students did not answer the question. Students still seemingly difficult to menafsifkan problems in mathematical form and image. At the current time is running out, some students just copy the work of another student.

To improve communication skills of students requires learning mathematics that support it. One way students are more exposed to the real problem that is often seen students so that they can directly visualize the problem then presents a problem in mathematics.

This mathematical problems of communication skills necessary to find a solution that can not be found anymore mathematical communication ability students is low. One way to do is implement improvements in the learning process. One determinant of the success of the learning process and success in achieving the goals of mathematics learning is a learning device.

Learning device is a device used in the learning process that consists of a syllabus, lesson plan (RPP), teaching materials, and achievement test. Devices that guide the implementation of learning is the Learning Implementation Plan (RPP). Teachers and students activities depicted in the RPP. All learning steps set out in the RPP. To boost the students' mathematical communication skills, learning the necessary steps to refer to direct students to be able to build his own knowledge (construction). RPP is used in some schools did not lead students undertake activities to build their own knowledge.

Based on Figure 1 above, the learning method Lectures, assignments, and frequently asked questions. Steps core activities in the RPP have yet to lead the students to be actively involved in learning. In addition, there is a problem yet to be seen given that the real world is associated directly with the student to be done to build their own knowledge. Build your own knowledge will help students master the learning well. Therefore, it is necessary RPP to support this. Required the development of lesson plans that help students understand the material by associating the context of everyday life.

Teacher as facilitator should be able to provide learning resources to support students discover and construct their own knowledge. Measures to achieve this, students are guided and directed teachers. Therefore, it is necessary learning resources that support it and can improve communication skills. Learning resources can be LKPD.

LKPD are teaching materials in which there is a learning steps that can help and guide the students construct their own knowledge and abilities of Use LKPD will direct students' activities to be performed. LKPD to facilitate teachers in implementing the learning process.

Reality on the ground LKPD or existing worksheets that have not been developed in accordance with the needs of students, so that the learning objectives have not been achieved to the maximum. Presentation of material in LKPD make students still passive in the learning process, as well as the material does not directly tied to the real world. Associate materials with real world makes students more easily understand the material. So the more enterprising students learn math and realized that mathematics encountered in life. LKPD involves addressing inadequate to train the students' mathematical communication skills.

LKPD not contain activities to find their own concepts because students simply accept without participating invented the concept of the lesson and at the end students memorize the material provided. So students only remember the concept of the same material, and if given exercises that students can not work on its own without seeing the completion of sample questions given.

Geometry is one of the important lessons learned in school. The forms geometrical flat side can be attributed directly to everyday life. The forms of geometry or flat wake are often seen and used in everyday life can be used as media for learning. Students' ability to interpret about the story in the form of images, a provision for students to solve word problems. Without describing the first, then the student can not complete the question. The ability of students to interpret mathematics in the form of oral, written and images are indispensable.

Based on the above problems, it requires serious effort. Solutions that can be done is to create teaching materials in the form of contextual based LKPD. The concept presented in LKPD not instantaneously, but is the result of the construction of the students themselves with the knowledge to optimize its existing early so that students are actively involved in the learning process. Students are helped to see the significance of the material being studied by linking the material with everyday life. With contextual based LKPD students are expected to construct their own concepts learned, so learning more meaningful and can hone the skills of mathematical communication.

LKPD LKPD serving contextual material and exercises that lead students to be able to communicate mathematical ideas, concepts, and skills they have learned to find a new knowledge. Given mathematical problems related to everyday life as well as questions that are relevant as a guide in finding mathematical concepts. Connecting material with real life issues, will be more demanding students to construct mathematical ideas, presenting a statement in the form of images, as set forth in one of the indicators of communication skills. In LKPD will be made steps in accordance with contextual measures, namely: 1) constructivism; 2) finding; 3) ask; 4) community learning; 5) modeling; 6) reflection; 7) the actual assessment.

This became the basis for researchers to conduct research development of the device based learning contextual form of RPP and LKPD to improve mathematical communication in class VIII SMP / MTs. "The problem in this research is" What is the process and results of software development based learning Contextual valid, practical and effective way to improve the communication skills of students in class VIII SMP? ". Based on the formulation of the problem that has been raised, and then the development of the RPP and LKPD aims to produce devices based learning Kontestual valid, practical and effective in class VIII SMP.

RESEARCH METHODS

This type of research is the development of research using Plomp models, ranging from the initial investigation phase (preliminary research), phase of development or prototyping (prototyping stage) and assessment phase (assessment stage). Phase of preliminary investigations (preliminary research) consist of a needs analysis, curriculum analysis, analysis of the concept and analysis of student character. Needs analysis conducted by observation and interviews. Needs analysis is done by gathering information to determine the underlying problems of inequality in the learning process associated with the learning of mathematics. The collection of information is done by interviewing some of the students and teachers, to observe implementation of learning and analyzing the learning device (RPP and LKPD) exist.

The analysis conducted on the curriculum standards of competence (SK) and basic competence (KD) specified in the standard content of 2006. This analysis included in the Education Unit Level Curriculum (SBC) for subjects in class VIII SMP half 2. These analyzes serve as guidelines in developing devices contextual based learning for math materials 2nd semester junior class VIII. The analysis was conducted to see the material (SK, KD) Which can be presented on the device contextual based learning.

Analysis of the concept aims to define the content and materials needed in developing LKPD. The main concept is Understanding the properties of cubes, blocks, prism, pyramid, and its parts, as well as determine its size. This analysis aims to determine the content and subject matter that can be served at LKPD based contextual approach.

Analysis of the student's character is performed to determine the character of the students. In this study, which will be the subject of the trial is class VIII SMP aged between 13-15 years. To find out the character of students then conducted interviews with teachers and some students. Based on interviews with students, obtained LKPD not answer that can help students to understand the material well in order to achieve the learning objectives to the fullest. LKPD not interesting, not their color variations to make appeal to students to study harder.

RESULTS AND DISCUSSION

Needs analysis conducted by observation and interviews. This activity is carried out in several junior high schools in the District Fifty Cities. Based on interviews with teachers of mathematics, there was information that the teacher has designed lesson plans as a guide in implementing the learning process, but the RPP has not been directing the activities to be undertaken for the purpose of students achieved the maximum that can improve students' mathematical communication skills. Mathematical communication skills of students is still low. This is due to lack of curiosity of students, students are lazy do the questions in the form of word problems. Most students only reading matter without understanding or imagining if this problem is associated with real life, how to move it into mathematical form. If there are obstacles they stopped doing it, and immediately vacate the answer sheet.

Based on the observation of the implementation of learning obtained information that the teacher has used RPP and LKPD, but it did not facilitate the students to be actively involved in the learning process and the lack of activities for the students to construct their own knowledge so that students can understand mathematics well. Teacher gives a formula directly without involving the students. Giving examples of questions and exercises were routine, so as to make students less able to answer the question if it is given a somewhat different matter. Most of the students, simply copying the work of other students if hambir time runs out.

Curriculum analysis was conducted to see the material (SK, KD) Which can be presented on the device contextual based learning. In addition, the curriculum analysis conducted to determine whether the material (SK and KD) which is in the curriculum has been ordered by both, as well as to determine whether the material has been adequate for the achievement of learning goals to the fullest. SK elaboration, KD and indicators of achievement of competencies into consideration to determine the necessary concepts in mathematics learning and measure achievement of SK and KD. Analysis of the concept aims to determine the content and subject matter that is needed in the development of learning tools.

Analysis of the concept aims to define the content and materials needed in developing LKPD. The main concept is Understanding the properties of cubes, blocks, prism, pyramid, and its parts, as well as determine its size. The discussion material on the nets geometry flat side presented together when talking about determining the surface area geometry flat side.

Analysis of the student's character by interview and observation. Interviews were conducted with teachers of mathematics known that during the learning process there are still many students who can not understand the material well, practice questions on LKPD only be done if the steps or forms of matter equal to a given problem. If you've replaced the words matter with the same purpose, they are less able to understand the purpose matter.

Based on observations, it appears that students are less active in the learning process and the students have not been able to construct knowledge. Students are less visible enthusiasm in learning. When the lesson begins there are students not driving out the book at all. When the teacher asks about previous material, only a small percentage of students who can answer.

CONCLUSION

This research is aimed at generating a development based Contextual learning device in the form of RPP and LKPD. Research will be conducted on the device development process contextual approach based learning in class VIII SMP on the material side of Flat form Build Space RPP and LKPD implemented Plomp development model consisting of three phases which initial investigation, the development phase and the assessment phase. In the preliminary phase carried out a needs analysis, curriculum analysis, analysis of the concept and character analysis as the basis for the development of students' learning devices. The yield on the needs analysis form the desired characteristics of the learning device is a device-based learning approach to solving the problem of RPP and LKPD. Analysis curriculum aims to adjust the relationship between concepts and basic competence can see using a contextual approach. The results of the analysis of the concept in the form of the order of subject matter that is needed in the development that can be achieved competence achievement indicator.

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PRELIMINARY RESEARCH ON DEVELOPING MATERIAL USING *VAN HIELE THEORY ON PLANE GEOMETRY FOR STUDENTS GRADE VIII*

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Abstract

This research was caused by lack of results mathematic students' learning in the material geometry, it can be seen from the observations and the results of daily tests of mathematics students in any of the material geometries. One way to overcome this problem is to develop a learning device. The device developed by using the theory of van hiele. In this study, the learning device has been developed lesson plan and worksheets for students to use the theory of van hiele. This type of research is the development of research using a model Plomp which consists of three phases: a preliminary analysis, the development stage or the prototype phase and the assessment phase. In a preliminary analysis, the researchers conducted a needs analysis, curriculum analysis, analysis of student and analysis concepts. In the development stage or phase prototype device, a device developed will be validated by five experts, three people mathematician, an Indonesian expert, and one educational technology expert, if the device belumvalid, then be revised. Practicality is seen through the results of analysis of the implementation of learning observation sheet, interview and questionnaire responses for students and teachers. Effectiveness seen through the observation and analysis of the activity of student learning outcomes.

INTRODUCTION

Mathematics is a subject that has an important role in daily life - today , both for mathematics itself and other sciences. Given the importance of math , then math is taught to students ranging from primary school to college level . Mastery of strong math early on will support student success in the face of constantly evolving life , let alone a mathematical object or material that is associated or connected with daily life - today .

The purpose of learning mathematics is Understanding the concepts of math , use a template as alleged in problem solving , mathematical manipulations both in simplification , as well as analyzing the existing components in problem solving , Communicate ideas , Have respect for the usefulness of mathematics in life , have the attitudes and behavior that corresponds to the value -value in mathematics , Conducting motor using mathematical knowledg [1]

Teachers play an important role in learning, the teacher is responsible for organizing, directing, and creating an atmosphere that encourages students to carry out activities in the classroom. Teachers should always be able to improve students' understanding of the material he taught.

Geometry occupies a special position in school mathematics curriculum, because of the many concepts contained therein and its application in everyday life. The material studied the geometry of objects in the form of facts, concepts, and principles. By mastering these objects well, expected verbal, visual, drawing and logical thinking students can grow and flourish, but evidence on the ground shows that learning outcomes are still low geometry.

Many students still have difficulty in understanding the material geometry, for example students is difficult to distinguish a right angle, as well as the students difficult to recognize and understand the wake flat, kind of - kind of flat wake, students can not distinguish seeking circumference and area of a flat wake triangle and rectangular. It is because students have difficulty in understanding the facts, concepts and principles, so that the achievement of learning outcomes on thinking skills in geometry is still not satisfactory.
Low student mastery of the material geometry can be caused by internal factors and external factors, internal factors are derived from within the students and external factors that come from the outside environment of students. One of the internal factors that affect the success of learning geometry is intellectual development, where the ability intelectual very important role in the understanding of mathematics.

In addition to internal factors, there are also external factors that can affect the success of studying the geometry of the method of teaching teachers, facilities and infrastructure support as well as the surrounding environment conducive students. In addition, the learning methods that do still centered on the activities of the teacher as a conduit of information (the subject matter) so that students become passive. Students do not have the opportunity to find their own concepts taught since most students are active only makes the course record. As a result, students only learn to memorize so that lack of understanding of the subject matter.

Of the two factors above researchers want to use products to enhance students 'understanding of geometry, One alternative researchers in improving students' understanding of the geometry of the material is to use LKPD. This LKPD later will include how to understand the geometry of the material by using the Van Hiele theory, so that will improve student learning outcomes.

Geometry Van Hiele is serving activities geometry math level of recognition that students begin to learn about a geometric shape overall but has not been able to find out their properties - properties of geometric shapes he sees, the analysis of which students are able to understand the properties of shapes geometry, sequencing that students are able to carry out the conclusion , that we know called deductive thinking , deduction proved that students with a statement about the geometry by using the logical and deductive reason , and accuracy which students can find the difference between the two structures . In accordance with the theory , the higher the grade the more grain activity levels higher and the lower the class the less grain activity levels higher . It is based on the more experience gained geometry students the higher levels of student thinking in geometry .

It is also supported by the observation that researchers do in junior high school is also seen that there is little understanding of geometry , where they have not been able to distinguish the form of flat wake similar , properties - properties Flat , such as the difference in the nature - the nature of the square and the square , rhombus and parallelogram , when seen from the level of thinking , junior high school students should be able memebedakan nature - these properties, because they have learned about the flat wake at a basic level.

It is therefore necessary to design mathematics learning involves students actively . Students should try to find their own patterns and structure of mathematics through learning experiences so as to understand the subject matter , also supported by the use LKPD to improve pemahamn students in accordance with the level of knowledge they have . In connection with the foregoing , the mathematics is done is learning mathematics by using Van Hiele learning theory , which is a theory of the development of thinking in learning and to resolve the problems of geometry. This theory also guide students to construct knowledge , so based on this, the development is embodied in a study entitled " Development Learning Tool

Matemtika Using the theory of class VII Van Hielle Students To Build Flat Triangle Materials And Quadrilateral

In Unum 's research development aims to produce Learning Tool use Van Hiele theory to improve student understanding of geometry . The aim in particular is to describe the process and results of the development of Learning Tool use Van Hiele theory is valid , practical and effective

RESEARCH METHODS

This research is a research & development (design research) . According to Plomp (2013 : 15) , " design research design and develop interventions (such as learning programs , learning strategies and teaching materials , products , and systems) as a solution to the problem of education complex , as well as to improve knowledge of the characteristics of the intervention and the process for designing and developing, or alternatively to design and develop educational interventions (for instance : learning , learning environment , and the like) with the aim to develop or validate the theory .

The procedure of product development focused on three phases , namely Preliminary Research , Prototyping Stage and Stage Assessment .

The initial stage , evaluation is focused on the evaluation of the content . At the stage of prototypes , evaluation focused on relevance (content validity) , consistency (construct validity) , and practicalities . The next stage is focused on the practicalities and effectiveness when products are tested .

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Learning Design Divisions of Fractions Use Fractions Board

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Abstract

This study aims to produce Learning Trajectory on the subject of the divisions of fractions by using a fractions board In addition, this study also aims to help students discover how the concept of divisions of fractions by using a fractions board that has been designed for the material fractions. The study involved students of class V SD Baitul Islam A'La Lubuklinggau many as 25 students. Basic research is the asumption that learning in the classroom has been designed in advance so as to produce learning trajectory. The results of the learning trajectory indicates that the approach is realistic mathematics Indonesia (PMRI) students can understand the concept of division of fractions. Learning Trajectory in this study contains a series of learning processes in two learning activities using realistic mathematics Indonesia (PMRI). The method used in this research is the research design consisting of three step of research, the first pleminary design comprise literature studies and designing Hypotenical Learning Trajectory. The next step is a design experiment consisting of pilot experiment and teaching experiment. Pilot Experiment phase consisted of 6 people or small groups of students, while teaching experiment consisted of 25 people or a large group. the last step this research is the analysis of representative

INTRODUCTION

The division of fractions is one of the material taught in primary school. This material is quite difficult to understand. According to (Septi, 2012) there are a lot of mistakes made by the students in performing division of fractions. One of the mistakes made by students in the division of fractions, for example, students simply divide the numerator of the fraction with the numerator in the fractional divider divider and also split both the denominator or multiplying fractions divided by the fractional divider without changing the fractional divider in the form of its inverse.

There are many activities in daily life associated with the division and fractionssuch as cutting the cake and then distributed to several people with the same amount of average. Or at social events where organizers of social events share some basic needs with equally to those in need, for example, families living in RT 05 kgberas get 5 kg of oil and ¼ ½ kg of sugar.

Two of the above activities shows that the division and fractions are two things that can not be separated in everyday life. One approach in mathematics learning in which the learning of mathematics starting with things that are close to the students approach is to use Realistic Mathematics Education (RME), is an approach to learning mathematics developed in the Netherlands since 1970. RME rooted in a theoretical view Freudenthal that mathematics as a human activity (Gravemeijer, 1994). In the development of RME in Indonesia known as realistic mathematics approach Indonesia (PMRI).

In PMRI approach to learning mathematics starts from the most concrete so that the math seemed so real and close to the students. PMRI in Indonesia adapted to the natural conditions and characteristics of students in Indonesia itself.

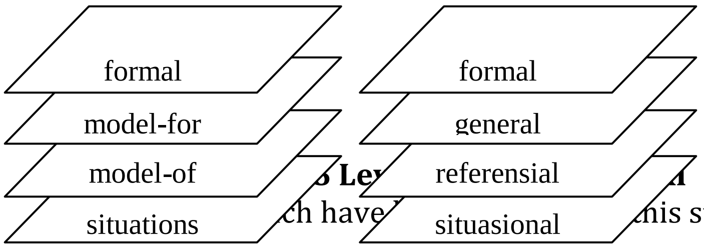
REVIEW OF LITERATURE

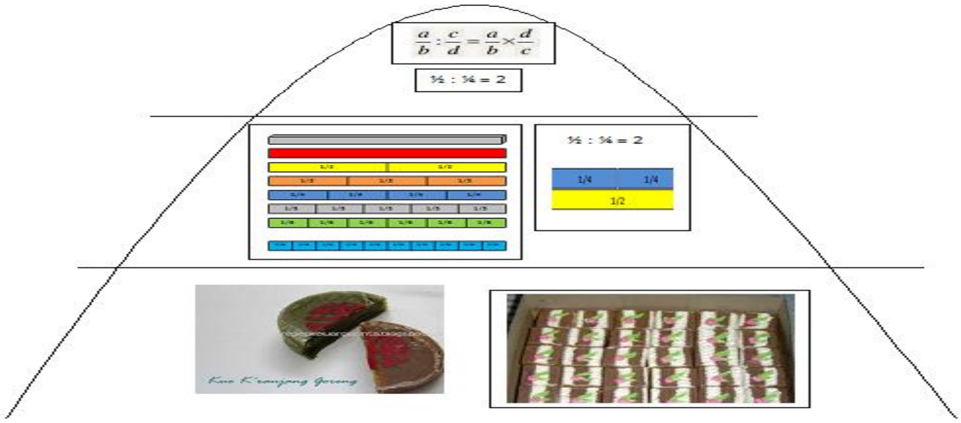
Realistic Mathematics Education (PMRI)

Indonesian Realistic Mathematics Education (PMRI) is an approach adopted from the Realistic Mathematics Education (RME), is an approach to learning mathematics developed in the Netherlands since 1970. RME rooted in a theoretical view Freudenthal that mathematics as a human activity (Gravemeijer, 1994). This shows that mathematics is actually very close to everyday life, in every activity of life. Such as shopping, banking and other trading activities sebainya. There are five characteristics PMRI by Treffers (Zulkardi, 2002) namely:

a. *Phenomenological exploration* atau *the use of context*
b. *Using models and symbols for progressive mathematization*
c. *Using student's own contribution and production*.
d. *Interactivity*
e. *Intertwinement*

According Gravemeijer (1994), there are four kinds of learning PMRI level, namely situational, of the model, the model for, and formal which can be seen in Figure below





METHOD

This study uses research methods of design (design research) that is an appropriate way to answer questions of researchers and achieve the objectives of the study. In this study, there were allegations of strategy and thinking students who are subject to change and evolve during the learning process. This shows that there is a cycle of repetitive processes of thought experiment (thought experiment) toward the learning experiment (intruction experiment). In each cycle, conducted in anticipation of a thought experiment to imagine how the proposed learning activity can be used in the classroom, and what can students learn as they participate in it (Bustang, Zulkardi, Darmawijoyo, Dolk, and van Eerde, 2013).Metode *design* *research*memiliki tiga tahapan penelitian yaitu *pleminary design*, *design experiment (pilot exsperiment* dan *teaching experiment)* dan *analysis representatif.* Dasar penelitian ini adalah dugaan pembelajaran di kelas sehingga menghasilkan lintasan belajar. Dugaan tersebut dianalisis lalu didesain kembali dan direvisi kemudian di implementasikan lagi (Gravemeijer dan Cobb, 2001).

At pleminary stage design, which is the first stage of the method of design research conducted a literature review on learning material surface area geometry flat side, scientific approach and curriculum, 2013. Furthermore, researchers have discussions with grade math teacher about the condition and what things are needed during the study. Next will be designing the hypothetical learning trajectory (Hypotenical Learning Trajectory), which is a hypothesis or conjecture how the thinking and understanding of students thrive in a learning activity which in this study using a scientific approach that is specific to the material surface area geometry flat side. According Gravemeijer (2004) HLT consists of three components namely: a. The purpose of learning mathematics for students; b. Learning activities and contexts that are used in the learning process; c. Conjecture process of learning how to identify the understanding and strategies for emerging and developing students when learning activities done in class. HLT developed based on the literature that has been reviewed and adjusted to the actual learning during the experiment teaching material surface area geometry flat side.

The second phase of this study is the Design Experiment consisting of a pilot experiment and experiment teaching. In the pilot experiment conducted to trying HLT has been designed. The trial at this stage, the six students who do not come from a class that will be teaching exsperiment. six selected students have different abilities consist of two high-ability students, two students and two people capable of being low-ability students. Exsperiment pilot aims to test the hypothetical learning trajectory (HLT) have appropriate initial or repeated revisions still need to be done. Furthermore, from the results of this phase, researchers will gain an overview of the condition and capabilities of students as research subjects.

Teaching Experiment aims to test the design of hypothetical learning trajectory (HLT) that have been tested in pilot stage experiments and revised. At this stage hypothetical learning trajectory (HLT) is the main guidelines of what the focus of the learning process. The third phase of this study is Restrospective Analysis. Where the data obtained in step teaching experiment in the analysis and the results of the analysis are used to design the next learning activity. Analysis at this stage aims to determine how the students can generalize on learning activities covering scientific observe, to question, to reason, to try and establish links to the material surface area geometry flat side that has been designed to answer the research questions. This stage relies on theoretical objectives to be achieved, so that the analysis conducted to determine the local data support the theory instruction (LIT). At this stage of reconstruction and revision of local instruction theory. During the study, some data collection techniques such as video recording, student activity sheets, observation sheets, interviews, and field notes were collected and analyzed to improve HLT has been designed. Data were analyzed retrospectively together HLT which becomes the reference.

DISCUSSION

Research is penelitiandesain research consisted of several stages which is preparing for the exsperiment, Experiment and the final design Restrospective Analysis. The instructional design created in this research is only at the stage of preparing for the exsperiment. The following activities conducted by researchers at the stage of preparing for the exsperiment

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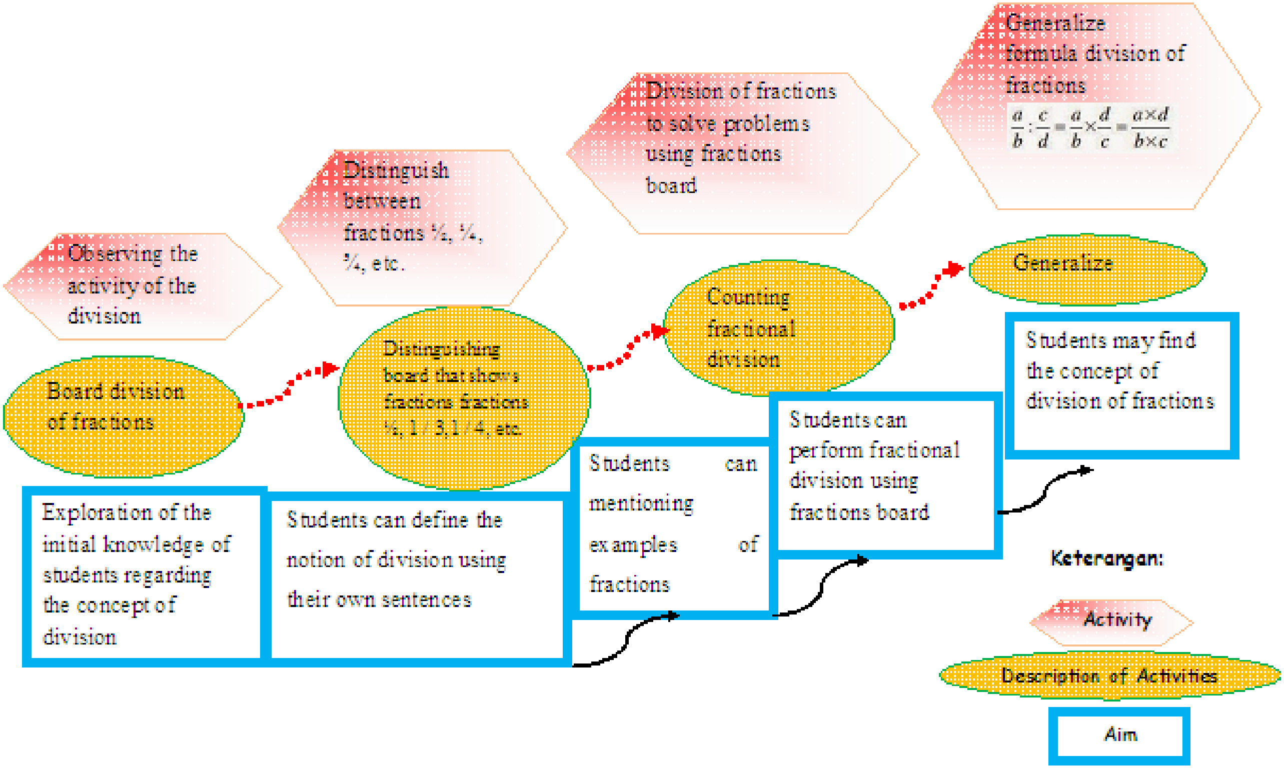
Literature Review

At this stage, a literature review regarding the material fractions, mathematical approach realistic Indonesia (PMRI), the curriculum used in schools where researchers will conduct research and researchers also held discussions with mathematics teachers regarding classroom conditions and what things are needed for research ongoing. Based on a study conducted by researchers turned out material fractions have been known even since they were students in the fourth grade of primary school and further deepened when the students were in the fifth grade of primary school. Fractional material including material that is difficult dimengertii students, this data is obtained based on the results of interviews with the subject teachers concerned. In addition, realistic mathematical approach Indonesia (PMRI) have not been applied in Islamic schools Baitul A'la bermaksuk place where researchers conduct research.

Design Hypotenical Learning Trajectory

Hypothetical Learning Trajectory (HLT) is a hypothesis or conjecture how the thinking and understanding of students thrive in a learning activity which in this study using a mathematical approach realistic Indonesia (PMRI). HLT is composed of three components namely: a. The purpose of learning mathematics for students; b. Learning activities and contexts that are used in the learning process; c. Conjecture process of learning how to identify the understanding and strategies for students who emerge and evolve when learning occurs in the classroom activities. Here HLT developed at the stage of preparing for the exsperiment:

HYPOTHETICAL LEARNING TRAJECTORY DIVISION OF FRACTIONS



The explanation Hypothetical Learning Trajectory (HLT) contained in the image above is as follows:

Activity 1:

- Students are given a video on the division of fractions, it aims to explore the early pegetahuan students about the concept of division. Further exploration of the division of fractions also use the board first fraction has been prepared researcher.
- After two previous activity directed students in order to create division definition using their own words and at the same time students are asked to give examples of fractions. Halini intended that researchers dapatmengetahui extent of prior knowledge of students about examples fractions
- The next activity the students were asked to do the division of fractions using a fraction board provided. In this activity students were given about the distribution of fractional complete with student activity sheet. All activities are given to students is presented in the form of student activity sheet (LKS). Furthermore, students are asked to make a conclusion

Activity 2:

- After activity 1 above. Students re-awarded student activity sheet (LKS) which contains the activities of the division of fractions. In this activity will be seen the extent to which the student's ability to understand the concept of division of fractions. Some of the problems presented in the second activity is the fractional division problems with numbers more difficult. But for students who understand the concept of division of fractions in activity 1 and be able to do even without menggukanmembagian fraction fractions division board.

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DEVELOPMENT OF GUIDED DISCOVERY-BASED MATHEMATICS LEARNING MATERIALFOR GRADE XI-IPA OF SENIOR HIGH SCHOOL

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Abstract

Learning material is an important factor that can influnce the quality of learning. A good learning materials should be able to make the students find their own concepts.In this case, it is required to develop mathematics learning materialwhich can fasilitate the students in finding the concept. In this research, it has been developed guided discovery-based mathematics learning material that is expected to achieve that goal. The purpose of this reserch was to poduce a valid, practical and effective guided discovery-based mathematics learning material. This research uses Plomp model which is proposed three stages of developmentc: preliminary research, development or prototyping phase and assessment phase. The learning materials developed were a lesson plan dan student worksheet. Data validity analysis showed that guided discovery-based mathematics learning material resulting in extremely valid category because the learning material had a good validity both the content and construction side.

Keywords: mathematics learning material, guided discovery, Plomp model

INTRODUCTION

The school is one of the formal education that carry out a series of learning process activities guided by the curriculum. In this case, the school has a goal of producing a human being who has certain skills, intellectual level, and attitude to face the existing problems in everyday life, so that it can face the demands of the Era. The Learning is the main activities at school. The learning can't be separated by lesson plans. In order to organize activities that facilitate students to develop their ability to think logically, critically and creatively, teachers are expected to make the planning of learning, one of them by creating a lesson plan.

Lesson plan is all the equipment prepared, organized, and used by the teacher , so that implementation and evaluation can run effectively supaya and systematically. Ibrahim in Trianto [1] said that "the device used in the learning process is called lesson plans". According to Kaligis Darmojo and kaligis, [2] a good lesson plan should be able to motivate students to engage in learning activities. Therefore, the teachers are demanded to be able to develop their own lesson plan based on the curriculum, content, and characteristics of the students. The availability of a quality lesson plan is one of the factors that can support the learning process goes well and can improve the quality of education. Through the learning teachers can more easily implement the learning process.

But in fact, teachers haven't developed the lesson plan optimally yet. the Lesson plans, especially RPP and LKS. These are used by the teachers, but they havent motivated the students to play an active role in the learning activities. Most of the teachers still presume that they only created RPP as an administration, where as RPP is a reference for teachers to carry out learning activities to be more directional. The role of teachers and students in learning activities are also not described with detail on RPP. In addition, LKS as one of the materials is still limited. LKS commonly used by teacher is lks which is published by certain publisherLKS from the Publisher usually contains a summary of the material, some formulas and exercises. They are lack of guiding students to engage actively in the process of getting the concept or the formula. Sometimes LKS is useeaching learning process. Whereas the use of LKS can help the students to be more active and understanding of the material provided.

Based on interviews with a teacher at a private high school Pembda 1 Gunung sitoli. The teaching learning of mathematic is already good enough. Teachers are already running its task very well, but the learning process hasn't been optimall yet, the students are passive. In learning activities, the teachers teach the students directly without involving the students to find their own formulas as well as properties that exist on the matter. So that, the students tend to memorize the formula as well as properties that exist without knowing how to acquire it. As a result in problems provided by the teacher, the students are hard-pressed to determine which formula will be used. It is also caused due to lesson plans. It isn't facilitate students in learning. Teachers are more often using traditional methods that consist of speaking engagements, giving examples, and exercise because they think, it is more effective in the allocated time.

A good math learning should have variation approach based on material being taught. But the fact, almost all mathematical material are delivered by a monotonous method such as ; delivering content, question-answer and exercise. Students are less active in learning activities. Students are not involved independently in discovering his/her own concept of the material that he/she had learned. The teacher is more dominated by speaking in front the class, the the students listen and take a note. As a result, the students' activities become reduced, so that students would be hard to understand the material. Sometimes, most of the students don't listen carefully, some of them are busy wih their own activity

From the results of interviews with some of the students at the private high school Pembda 1 Gunungsitoli,it can be concluded that some students have difficulties in understanding mathematical concepts because the learning is dominated by teachers. As a result, the students are lazy to learn math. Furthermore, in the present study, most students feel bored and sleepy in class. Most students aren't focused, they tend to speak with their friend. Also, the exercises given by teacher can' t be done by the students. So it can be concluded that, the learning process can't run optimally. So it will affect the result of the students. it can be seen from the result of the XI-IPA students where the percentage of KKM students on final exams in two years 2014/2015 as much as 14 of 33 students or 42, 42%.

The fact above requires teachers' attention and creativty to construct a lesson plan. The Development of learning should be matched with students' characteristics, so that it's very important to implement the right approach in developing a lesson plan. In implementing the lesson plan, it can be applied based on the standard process such as conducting interactive learning, fun, challenge, and especially motivate students. Student involvement can encouraged them to find patterns, rules or formulas that will give them a new experience

Guided discovery is appropriate to develop lesson plan because it can make students active and have social interactions in learning process. In the process of the discovery of social interactions, students get the guidance of teachers from the beginning of learning so that they are more guided, as a result, the teaching learning process can run effectively. How far students mentored depending on their ability and the material being studied. Teachers act as tutors who help students to use their ideas, concepts and skills that they had learned before to gain new knowledge

Burner [4] said that "learning is the search for knowledge actively by students. Students try to find problem-solving with the knowledge, generating knowledge that is really meaningful. " According to Suherman, et al [5] said that "the word finding is an invention as a method of teaching done by students. In this method, the students find something by themself. This does not mean that it's totally new because it was unknown by others. " According to Suprihatiningrum [6] , the learning with social interactions, students find something new with the help/instructions of the teacher". More Markaban [7] said that "the discovery model of social interactions can be held individually or groups. This model is very useful for mathematical subjects in accordance with the characteristics of Mathematics ". It can be concluded the discovery of social interactions is the learning process that leads students play an active role to find themselves a new knowledge while the teacher acts more as a facilitator and supervisor for students both individually and group

The steps of guided discovery are (1) formulate the issue that will be given to the student with the data sufficiently, their definitions should be clear, avoid misinterpretation statements that ;(2) from the data provided From teachers, the students compile, process, organize, and analyze the data. The teacher's guidance can be given in the form of questions directly or can be stated in LKS. (3) the students compose a conjecture (forecast) from the results of the analysis. (4) when it is necessary, the conjecture should be checked by the teacher. It is important to convince the truth. (5) if its acuired certainty about the truth of the conjecture, then verbalize conjecture should also be handed over to the students for putting it together. (6) after the students find what they're looking for, let the teachers provide additional exercise to check if the results are correct.

Based on the description above, researcher will conduct research on the development of learning mathematics based guided discovery in order to support the activities of learning and facilitate the understanding of the students against the material especially for the students of Class XI-SCIENCE high school. As for learning devices being developed include lesson plan (RPP) and the student worksheets (lks).

RESEARCH METHODS

the research method is research development with model Plomp. The developments are the three stages model Plomp. The first stage is preliminary research (the initial investigation phase), development or prototyping phase (stages of development or prototyping) and assessment phase (assessment phase) [8]. On the preliminary research carried out needs, curriculum, Shiwa and concept analysis. In the first phase or investigated phase, it's used needs analysis, curriculum analysis, the student's analysis and analysis of the concept. At this stage of development or prototyping phase consists of prototypes 1,. the results of the design of the product; prototype 2, the results of revision of the product after carrying out its own evaluations (self evaluation) and expert review (expert review); prototype 3,the results of revision of the product after carrying out an evaluation of one-on-one (one to one); prototype 4, the results of revision of the product after carrying out the evaluation of the small group (small group). Next on the stage of the assessment phase is done field test (field test) to look at the practicalities and effectiveness study

instruments used on this research are self evaluation sheets, interviews, observation and validation sheet of lesson plan, teachers' questionaires , student's questionaire, each instrument is validated by experts. Validation of instruments is validated by 3 validators. The valid Instruments will be used in research. The research results are analyzed according to the type of data. Qualitative data were analyzed by qualitative and quantitative data are analyzed and categorized ,so that The conclusion can be taken quantitatively.

THE RESULT

At this stage, the researcher did the identification or analysis to develop learning mathematics based on guided discovery. This stage is done by analyzing the purpose within limtied material that will be developed.

1. Needs analysis

Collectiong of need analysis is done by by interviewing mathematic teacher at SMAS Pembda 1 Gunungsitoli and observe the implementation mathematic teaching learning process and lesson plan.

Based on the interviews with mathematic teachers, the researcher can conclude that the teachers are prefer to use conventional method because it's more effective in time, the ability the students also, the teacher didn't use students worksheet as a material in teaching learning procces, because of the previous experience. the students worksheet is only a collection of questions and materials. The result of the observation, the teaching and learning mathematic in the classroom hasn't been optimal yet, it's still teacher centered, the student only listened and take a not what they have listened. the Materials used by teachers of mathematics is only compulsory book

Based on that analysis, to create the learning process which involves students actively and effectively for students, one of the solution is providing good students worksheet or LKS as learning materials that are able to motivate students to participate actively in learning mathematics and designing learning activities in the classroom. So that, it needs the development of learning math such as ; lesson plan and student worksheet.

2. Curriculum Analysis

the purpose of Analyzing curriculum is to find out whether the material being taught is in compliance with the competence expected. The Curriculum analysis performed against the standard of competence (SK), basic competencies (KD) and indicators of achievement of the competencies (IPK). The results of this analysis are used to formulate indicators of achievement learning which became guidelines in the development of learning mathematics based guided discovery for the students of XI-IPA class. The curriculum analysis implemented on the students of XI-IPA class is the suitability of the material with a learning model of the guided discovery . the result of the Curriculum analysis can be used as consideration to create students worksheet based on guided. Through this students worksheet, the students can find the concept that will be studied by themself so that they can memorize well. it will guided the students to meaningful learning.

3. The Student analysts

Based on students analysis, it can be concluded that the students haven't been involved actively in learning. Many students who have not followed the learning well , it is characterized by the large number of students to carry out other activities in learning activity. Students also argued that the study has not been conducted to provide an opportunity for the students. also,the students expect the learning math can be done in a group because they never study in a group. And they expect to get other learning materials except compulsory books.

4. The concept analysis

It is a concept that aims to identify, specify and formulate the major concepts presented in the learning of mathematics. At this stage, a concept associated with other concepts makes a concept map. After the analysis , it can be said that the primary material is namely composition of functions and inverse functions. Furthermore, the main material is divided into several sub material.

B. the result of the *development or prototyping phase*

After learning indicators are formulated and the main concept is specified, then the next step is to design a lesson plan or RPP and students worksheet based on guided discovery.

1. Lesson Plan Design

a. characteristics of the lesson plan

Lesson plan is designed as a guide for teachers in teaching material. The component is designed based on Permendiknas No. 41 in 2007 about the standard process for units of primary and secondary education.

Learning activities presented on lesson plan based on discovery-based learning, that are integrated on guided discovery. Presentation the identity of lesson plan, a standard of competence, basic competence, indicators, aims, teaching material, the allocation of time, the source of learning and assessment is almost the same as the lesson plan generally. The learning is model used by teachers to bring about an atmosphere of learning and the learning process so that students achieve basic competency or a set of indicators has been established. The learning model is used by the method of the invention of social interactions. The selection of models, and learning methods are adapted to the situation and condition of the students, as well as the characteristics of each indicator and the competence achieved in each subjects. Learning activities on lesson plan is based on methods of discovery preliminary activities consist of social interactions, the core activities and activities cover outlined as follows: (a) activities of the introduction. The introduction is early activity in a meeting aimed at arousing the learning motivation and focus the attention of the students to participate actively in the learning process. Learning activities are accompanied by allocation of time in order to facilitate teachers implement the learning process; (b) the main Activities. The main activity is the process of learning to achieve learning objectives. On a main activity, the teacher must deliver the subject matter briefly, then students are faced with several problems related to the material being he had learned. Next the teacher asks students to discuss in groups students discuss all information contained on this issue in is categorized by way of writing down information known from the verbal statement correctly and write down questions that represent a problem in order to understand the problem well. Next the teacher asked one group to present the results of the discussions of the group in front of the class and other groups provide a response to an explanation of a group presentation. After a discussion group of students is asked to work on the problems the given exercises to see the student's understanding to the materials have been studied; (3) activities cover. Study concludes with a closing activity that can be done in the form of creating a summary or conclusions about material that will learn, and teachers inform the material that will learn for the next meeting.

b) Characteristics is student worksheet

The presentation of the material is categorized in the following stages in the discovery of social interactions in accordance with the opinion of the markaban. Discovery stages social interactions are done with the steps as follows. First, formulate the problem that will be given to the student with data to taste. In this section there is a formula problem that will be given to students in the form of the concept, illustration or a problem or question. Second, from the data provided, students composing, processing, organizing and analyzing data. The presentation of the outline of the given problem is done so that the students can analyze the steps what discovery is performed to find the students concept. Third, students compose a conjecture/forecasts of results. Student worksheet as being designed to facilitate students to make conjectures/forecasts. To direct the students compiled a conjecture (forecasts), given in the form of questions that will guide. From this, the guiding question expected students to compose a conjecture (forecast) from the results of the analysis that he did in the previous step. The results of the conjecture/forecasts of student answers written correctly that has been provided is student worksheet in. Fourth, when deemed necessary, the conjecture has been made by the student that were checked by the teacher. This is done to convince students of the forecast. After students discovered the concept you're looking for, the next step is to apply those concepts through problem exercises. A matter of practice is a means for students to measure their capabilities in understanding the material. A matter of practice drawn up from the low difficulty level, moderate to high. The question exercise provided furnished with a resolution to charge students. Next, to solidify the concept of understanding the student, the student is given assignments as an exercise at home to be able to increase the understanding of the concept or principle which has been studied and repeated material that has been studied in the home as homework. Student worksheet is used standard language in accordance with enhanced spelling (EYD). Student worksheet is used by simple language and communicative as well as in accordance with the level of understanding of high school students so that the presentation of the material in student worksheet can be understood the students well. Student worksheet question using sentences correctly arranged so that it is able to direct students getting the expected answers. Student worksheet as the discovery-based social interactions created using Microsoft Word 2013 with the size of A4 paper. Kinds of writing used in the student worksheet i.e. Comics Sans MS Jokerman and Book Antiqua with a 11pt font size to 16pt. background is student worksheet as dominant colorsare green and white. The color green was chosen because according to the research of Prof. Stephanie Lichtenfeld, an expert in the psychology of the Ludwig Maximilians University said that creativity can someone increase with just a fleeting look at the color green for 2 seconds. In addition, according to Basuki in his article entitled "the meaning of color in design", the color green symbolizes growth and expectations, and the white color symbolizes success. After learning device (lesson plan and student worksheet) discovery-based social interactions are done next is designed, named the prototype I device discovery-based learning, social interaction.

2. Self Evaluation Learning

The evaluation study was carried out on the device itself to see if there are still mistakes made when creating the prototype I learning devices. Things to note on the evaluation of its own among other things writing clarity, typos, errors of the use of the term, the clarity of the image and use of punctuation errors.

a. Self Evaluation of Lesson Plan

After having carried out an evaluation of its own, find some errors in prototype on lesson plan. The error is then corrected.

b. Self Evaluation of student worksheet

After its own evaluation is conducted, find some errors in the prototype I student worksheet. The mistake was later corrected.

3. Learning Validation Device

Learningvalidation device Prototype I has designed and evaluated learning device its own validation are performed. This validation was carried out by a competent expert in the respective field. Prototype-based mathematics learning device I discovery of social interactions are validated by five experts consisting of three mathematics education experts, one linguists expert and one expert on educational technology.

a. Lesson plan validation result

During the validation process of prototype-based discovery of lesson plan I social interactions. There are some revisions were carried out on the basis of suggestions from the validator. Having viewed a variety of input and advice from the validator, implemented improvements in the lesson plan is based on the advice of the validator. After the implemented improvements based on suggestions from the validator, lesson plan validated again by the validator. Overall lesson plan-based discovery of social interactions that are developed are said to be very valid with average 3.27. So, it can be concluded that lesson plan-based discovery of social interactions for the students of Class XI-IPA SMA has been valid. The prototype I lesson plan based discovery of social interactions that have valid next named prototype II lesson plan based discovery social interactions.

b. Student worksheet as validation result

During the validation process the prototype I student worksheet based discovery of social interactions. there are some revisions were carried out on the basis of suggestions from the validator. Having viewed a variety of input and advice from the validator, carried out repairs on the is student worksheet based on the advice of the validator. After the implemented improvements based on suggestions from the validator, are student worksheet as validated by the validator. The results of the validation are student worksheet as the didactic aspect to be seen that obtained the average validity 3.44 with very valid category, with content aspects of the average validity 3.26 with very valid category, language aspects 3.35 with very valid category, and aspects of the presentation of valid categories 3.05. The overall validity of the is 3.28 with very valid category. Thus it can be concluded is student worksheet discovery-based social interactions has been valid. The prototype I student worksheet based discovery of social interactions that have valid next named prototype II lesson plan based on discovery social interactions. Thus it can be concluded that the device mathematics learning- based discovery is already valid social interactions both in terms of content as well as in terms of construct.

This research is research development that generates the device discovery-based learning, social interactions. The device in the form of lesson plan and student worksheet. Based on the research that has been carried out can be summed up in the following things the results showed that the learning of math-based discovery of social interactions that are developed within the category of very valid both in terms of content as well as in terms of construct.

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The Development of Learning Materials of Integrated Science Used 7E *Learning Cycle* to Improve Student Learning Outcomes in SMPN 11 Padang

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Abstract

Integrated science learning in Junior High School (SMPN) 11 Padang implemented through theoretical with lecture method. Teachers do not understand the Integrated Sciences material. Presentation of learning material was separated between the matter of physics, biology, and chemistry. Learning materials have not been able to activate the students in integrated science learning. Most of the students (56,78%) have not mastered the integrated science lesson. To solve this problem developed learning materials of integrated science with 7E learning cycle models. The 7E learning cycle model was the learning cycle which is one learning model with the constructivist approach. The 7E learning cycle model consists of seven stages, namely; Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. This research aims to develop the learning materials of integrated science with 7E learning cycle models that valid, practical, and effective. Research and development used the Plomp model. The research instrument was the interview guide, observation sheets, validation sheets, questionnaire, activity assessment sheet, and achievement test. The results showed that the learning material was included valid categories (3,61) based on expert judgment. Learning material was included practical categories based on the responses of teachers (3,76) and students (3,54). The effectiveness of learning materials based on the positive activities of students (3,5) and the average of student learning outcomes (3,55). Thus the learning materials effectively improve the student learning outcomes. The science teachers were expected to use the learning materials that have been developed.

Key words: 7E *Learning cycle*, *integrated science.*

INTRODUCTION

Thematic Learning is a learning whic combine material from sort of discipline. One of consideration is that students' development, especially elemantary level (SD), is relatively hollistic therefore complicate the students if learning conducted sepaartely for each subject. Integrated Thematic Learning is learning using a thema for unifying several subject contents to make connection each other. Towndrow and Tan (2008) suggest that Integrated Thematic Learning integrate some competence from different subjects into a particular theme. Kemendikbud (2014) explain that Integrated Thematic Learning use theme as unifier some learning resources in one learning time. The purpose is to help student understand a number of concepts and apply it into their daily life. For supporting this, an interesting learning media is needed.

Science learning contains a lot of facts, principles, and procedures. Lawson (2001) tell that common science learnings are presented in complex sentence and use many terms so students have to remembering it. Indeed, science learning require deep understanding. Students knowledge must be constructed in order that remain well in students memory. One of effort is giving direct experience and connecting the learning material with concept.

Based on survey and interviews, it is known that books which available is less in number and color. Not every students can use the books. Teaching methods used has not been able to stimulate students' activity and creativity, especially for class VI. Besides, teachers' motivation is low. Schools should provide a well prepared learning process. In this case, learning tools become one of important key.

Learning material is set of information arranged to be learned by students in order to support learning process. Depdiknas (2006) propose that learning material is a set of contents systematically in written or verbal presentation to create supportive learning atmosphere. Mostly learning material is completed illustration to make concept or ideas clearer. According too Prastowo (2014:298), there are four types of learning material; (a) printed such as handout, book, module, worksheet, brochure, leaflet, *wallchar*t, photo, figure, and models, (b) audio such as cassette, radio, disc, and *compact disk* audio, (c) audiovisual such as *video compact disk* and film, (d) interactive learning material such as interactive *compact disk* interaktif. In this research, we developed module. A qualified module can perform validity, , practicality and effectivity (Plomp, 2013. The details descriptor is presented in Table 1.

Table 1. Criteria of qualified module (Plomp, 2013)

No	Quality aspects	Criteria
1	Validity a. Relevance (content validity) b. Consistency (construct validity	Learning material is developed using scientific knowledge. Learning material is developed logically.
2	Practicality	Learning material can be used according to the setting designed.
3	Efectifivity	Learning material reach the result wanted hasil yang diinginkan

Learning cycle is one solution to overcome the problems in class VII. This model demands students' creativity in order that students participate through asking question related with previous material. Students have to be directed to find the information, doing experiment, and applying their knowledge in daily life. *Learning cycle* is applied formally in science program of elementary school, is Sience Curriculum Improvement Study (SCIS) (Einsenkraft, 2003). It is proposed by Robert Karplus in 1967. Previously, it consist of *exploration, concept introduction*, and *concept application*. Then, the model was futher developed into *guide discovery* and the stages are *exploration, invention, and discovery* (Lawson, 2001). Later, three cycle of learning (3 E) develop to 4 E, 5 E, and 7 E. *Learning cycle* 7E consist of *elicit* (appearing students' preknowledge)*, engage* (idea, learning plan, and experience)*, **explore*** (investigate)*, explain, elaborate, evaluate*, *and extend.*

elicit

1. Engage -------- Engage
2. Explore ------------------- explore
3. Explain -------------------- Explain
4. Elaborate ---------- Elaborate
5. Evaluate ---------- Evaluate, extend

Figure 1. The proposed 7E learning cycle and Instructional model

(Einsenkraft, 2003)

Research question is How to develop science learning material using *Learning cycle* 7E for students class VII which is valid, practical, and effective?

RESEARCH METHOD

This is a r*esearch and development study*. R*esearch is conducted to obtain information about user need in step of needs assessment*. Development is aimed to produce learning material using *Learning Cycle* 7E. The product is applied in core activity during learning in steps presented in Table 2. The Model applied is Plomp (2013), consist of *preliminary research, prototyping phase,* and *assesment phase.*

Table 2. Details of development steps

No	Phase	Activity	Criteria/target
1	*Preliminary research*	Introduction analysis	1. Curriculum 2. Learning Material 3. Concept 4. Students
2	*Prototyping phase*	*Prototype I*	1. *Self evaluation (researcher)*
			2. Instrumen validation
		Prototype II (personals evaluation)	Small bumber of students
		Prototype III (group evaluation)	Half of students
		Prototype IV (Field Test)	Students
3.	*Assesment phase*	Product effectivity test	Learning material

The data gathered from validity, practicality, and effectivity test. The validity data is obtained from expert *judgement*. Practicality data obtained from interview with sudents and teacher quistionnaire. Efefctivity data obtained from students' learning activity and learning results.

Table 3. Criteria of Evaluation for each phaseof development

No	Phase	Criteria	Description of activity
1	*Preliminary research*	Emphasize on content validity	Problem analysis and study the literature
2	*Proto-typing phase*	Focus on consistency (construct validity) and practicality. Then, prioritise practicality, continue to effectivity	Developing Prototype which will be tested and revised based on formative eavluation information.
3	*Assess-ment phase*	Practicality and Effectivity	Measure wether user can use productct and want to apply it further? Is product effective?

Source: Plomp (2013)

Based on table above, evaluation is conducted for each developmnet phase, yet it has different function in each cycle.

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Based on data analysed, analysis technique applied is qualitative and quantative analysis. Data produced from learning material validation, observation, questionnaire, and achievement test analysed descriptively and compared to the criteria. Learning process data analysed quatitavely through revision the reading and steps of development research. Revision is based on researcher note, observation information about learning process, and expert view.

RESULT AND DISCUSSION

Learning material base *Learning Cycle* 7 E

The research has produced science learning material base *Learning Cycle* 7 E. *The model consist of* learning cycle with steps *elicit, engage, explore, explain, elaborate, evaluate*, and *extend*. The systematical framework is Identity, Standard Competence, Basic Competence, Learning purposes, larning activity, evaluation, and references. Activity of science learning refer to Bybee et.al. (1989), presented in Table 4.

Table 4. Steps of *Learning Cycle* 7 E

No	Steps	Learning activity	
		Teacher activity	Students Activity
1	*Elicit*	1. Show object/events/proposing the question to motivate students. 2. Connecting students' preknowledge 3. To stimulate students' curiousity by proposing open question	1. observe and anwer the question 2. connecting preknowledge with the learning material 3. being motivated to answer the open question
2	*Engage-ment*	4. ask students to share their thinking? 5. stimulate students to interact each other 6. propose guided question	4. explore objects and phenomens though 5. interact with media or peer during discussion 6. answer the question
3	*Explore*	7. facilitate the experiment 8. motivate students to use learning experience gained from experiment 9. facilitate group discussion to predict observation 10. observe the activity	7. prepare experiment 8. use learning experience to support experiment 9. doing experiment 10. write the data of observation
4	*Expla-nation*	11. ask students to explain students' understanding. 12. recognizing new concept and new skill and correcting previous concept and skill 13. ask student to point fact or data in making explanation	11. explain concept and process during *hands-on activity* 12. listen explanation from teacher 13.apply learning experience to giving explanation
5	*Elabo-ration*	14. recognize new concept and using alternative explanation 15.extend students' understanding and skill. 16. focusing the students on the conceptual link 17. stimulate students to apply learned idea	14. listen teacher's explanation 15. apply new concept in different context 16. making link between new experience and previous experience 17. apply learned idea

6	*Evaluate*	18.proposing question which is directing conclusion 19. observe and record learning activity and students' understanding 20. evaluate students' achievement and learning effectivity	18. answering and reasoning 19. making conclusion 20. following evaluation
7	*Extend*	21. facilitate students to propose the ideas/opinion 22. interview student 23. ask student to make learning reflection	21. compare the ideas 22. being assesed 23. involved in learning reflection

Learning Material Validity

There are three validator who assess content validity, construct validity, and readable. The result can be seen in Table 5.

Table 5. Validation results

Validator	content validity	construct validity	readable	Average
FF	3,6	3,4	3,7	3,6
SF	3,7	3,5	3,8	3,67
YF	3,5	3,6	3,7	3,6

The result show that Science Learning Material base *Learning Cycle* 7 E is valid. Prastowo (2013) said that science learning material is collection of material which used by teacher and students in learning process to create learning atmosphere.

Practicality

Field test is conducted to obtain information about practicality of learning material development. There are four times of field test. Th observer is science teacher of SMPN 12 Padang. *O*bservation result show that students can follow the learning process. Positive response from teacher and students support the finding. Finally, it can be assumed that developing of science learning material base *Learning Cycle* 7E is categorised practical.

Table 6. Result of practicality

Aspect	average	category
Learning process applicable	3,86	Very practical
Teacher Response	3,76	practical
Students Response	3,54	practical

Efectivity

Based on learning activity, efectivity level is 3,5. Learning achievement on cognitive aspect is 3,76, mastering percentage is 87,1%. Learning achievement on psycomotoric is 3.64 dan mastering percentage 87,4%. Learning achievement on affective is 3,26, categorised into good and very good criteria. More than 85% of students meet mastery level. Yenilmez, and Ersoy (2008) told that learning using *Learning cycle 7E can improve students aunderstanding adn learning result.* It can be concluded that Developing of science learning material base *Learning Cycle* 7E is effective to enhance students class VII' achievement.

Discussion

Developing of science learning material base *Learning Cycle* 7E is stated valid, practical and effective to improve learning acievement. Piaget explained that learning is development of cognitive aspect include ; structure, content, and function (Towndrow and Tan, 2008). Intelectual struktur is high level mental organisation owned by students to answer the question and solving the problems. Content is students behavior in responding problems. Function is intellectual development stage include adaptation and organisation.

During science learning using *Learning Cycle* 7E, students observe phenome happened in environment. Students try to interprete and expand the concept. So, students will not attend the class without preparation, yet bring their own concepts because students owned it befor sitting in the class (Citrawathi, 2006). E*ngagement phase aim to attract sudents interest in order to make connection with previous knowledge* (Carin and Bass cited in Lawson, 2001). The effect of this learning is focusing stduents' attention. Teacher does not need to explain the learning process, because students have learned it during introduction. Learning based *Learning Cycle* 7E give opportunity to share idea with peer in discussion in order to solve the problems prepared in understanding test or concept application (Einsenkraft, 2003). Besides, content arranged completely is easy to understand so can help students to gain relevance information. Ostlund (1998) suggest that learning is transfering the knowledge by students. Activity is fully determined by students while teacher prepare the material and guide the process. Steps in learning material base *Learning Cycle* 7E contributed to learning process. Hartlay & Davies (1978) state that learning material base *Learning Cycle* 7E have several excellence, are attractive, easy to be understood, and stmulate students to think actively. Students achievement using learning material base *Learning Cycle* 7E is relatively better than using common learning material (Bybee, et. all.,1989).

CONCLUSION

This development research produced Science Learning material base *Learning Cycle* 7E. the produc is valid, practical, and effective to improve students' achievement. More than 85% students meet mastery level. We recommend to use this product for science learning. for further research, another learning content is potential to be explored.

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THE DEVELOPMENT OF STUDY DESIGN OF PYTHAGOREAN THEOREM TOPIC USING REALISTIC MATHEMATICS EDUCATION (RME) APPROACH FOR CLASS VIII SMP / MTs

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Abstract

The Pythagorean Theorem topic is a fundamental topic in a variety of mathematical material, but Based on the results of preliminary observations, students do not understand the concept of the pythagorean theorem and have not been able to use it properly. One reason is that the concepts students learned have not been built coherently. Consequetly, the learning outcomes of the pythagorean theorem topic has not been optimal yet. This research aims to develop learning design of the pythagorean theorem topic using RME approach to provide an understanding of the pythagorean theorem topic and to have the skill at solving the problem for the students in class VIII SMP / MTs. This design includes learning trajectory of the pythagoreantheorem topic that consists of activities to draw various flat on rectangular coordinate and to calculate the area got up irregular in geoboard, the activity of finding the square root of a number through the square area using geoboard, activity of proving the pythagorean theorem through the relationships of the area of three squares of the sides of a right triangle and puzzle pythagoras and activity quantifies the side lengths of a right triangle is one of its corners 45^0 through a right-angled triangle isosceles and right-angled triangle in which one angle of 30^0 or 60^0 through an equilateral triangle, learning trajectory is declared valid by the five experts. The results of conducting the experiment showed that the learning of the pythagorean theorem topic can be done significantly. Besides the learning design will be valid, practical and efficient. Then, the learning trajectory can develop student's problem solving skills.

***Keyword**-RME, learning trajectory, the pythagorean theorem, problem solving*

INTRODUCTION

Mathematics is one of the subjects that occupy an important role in education because it is given at every level of education starting from primary level to university level, in addition to the time spent in math more than other subjects. As contained in the National Agency for Education Unit (BSNP) ie mathematics courses should be offered to all learners from primary schools to equip learners with the ability to think logically, analytical, systematic, critical and creative, as well as the ability to cooperate.

TIMSS report mentions that the mathematical abilities of learners Indonesia so far below other countries. Other than that reported in detik.com accessed on March 11, 2015, Programmme for International Student Assessment (PISA) under the Organization of Economic Cooperation and Development (OECD) in 2012 and then issued a survey that Indonesia was ranked bottom of 65 countries, in mapping capabilities math, reading and science. In West Sumatra also has conducted studies Fauzan (2012) related to mathematical literacy refers to the matter of PISA for junior high school students who indicated that the mathematical literacy skills of learners West Sumatra is still low. Further research conducted by previous researchers Daulay research results (2011) states that there are still many students who experience difficulties and mistakes in using the Pythagorean theorem formula.

Difficulties experienced resulted in the lack of understanding of students in the material Pythagorean theorem. In schools where researchers teach, the same thing happened. Learners are still experiencing difficulties and errors in answering questions about the Pythagorean theorem material, learners seem to just substitute the existing figures into the formula that they remember without understanding the elements in this formula, so the result is not correct.
Errors and difficulties experienced by learners during this time of Pythagorean theorem precisely because of lack of learning strategies used. In the process of learning mathematics in class most students choose to remain silent or passive and wait for the teacher to solve a given problem without any attempt to work on his own, an understanding of the material being studied is still low and the liveliness of the discussion group is also lacking. Almost all teachers provide routine matter and less challenging, most teachers are very dependent and rely heavily on textbooks they use.

Presentation material Pythagorean theorem on textbooks include information directly without giving learners the opportunity to make their own learning, learners are guided directly and receive information. Learners acquire knowledge not yet significantly because it is not directly involved in constructing knowledge. Thus, the knowledge they gained did not last long in the memory. If students do not understand the concept of Pythagorean theorem well, then students will not be able to solve problems in everyday life materials associated with the Pythagorean Theorem.

One way to solve these problems is to create a learning approach grooves Realistic Mathematics Educations (RME) or Realistic Mathematics Education. Realistic Mathematics Learning begins with an introduction to the real world in order to facilitate students in learning mathematics. In addition, students are also given the opportunity to find their own mathematical concepts presented in everyday life so that learners can solve problems related to learning materials. In creating learning activities with RME approach, the teacher does not directly provide formulas or concepts related to the material and sample questions. But in early learning teacher started the lesson by asking a real problem for the students in accordance with the level of experience and knowledge. Problems given course should be directed in accordance with the objectives to be achieved in the lesson, so that students can engage in meaningful lessons. When the teacher gives a form of problem, students are guided to develop or create models of symbolic of the problems or issues raised by the teacher. Learning takes place interactively. Learners to reflect on each step taken or the results of the lesson. By implementing learning activities through an approach Realistic Mathematics Educations (RME), it is expected that learners can understand the material and be able to solve mathematical problems related to the material well.

Theory RME depart from the opinion of Freudenthal that mathematics is a human activity and must be linked to reality. Freudenthal argued that learners can not be seen as passive recipients of mathematics that is so. Mathematics education should be directed to use a variety of situations and opportunities that enable learners to reinvent (reinvention) mathematics by their own efforts.

Dienes (1971) states that "Everybody knows that mathematics is an abstract subject". Mathematics is often a problem for learning abstract. Thus it is necessary to change the process of learning something abstract becomes concrete in mathematics. According to Freudenthal (1991), mathematics must be connected with the fact, is close to learners, relevant to people's lives, and the materials must be transmitted as a human activity. This means that materials must be able to be an activity of mathematics learners and provide opportunities for learners to discover mathematics through the practices of his own and in accordance with the cognitive level of learners.

Learners need to be guided towards the world of mathematics with a bridge called mathematical. According to Wijaya (2012: 41), "mathematical is a process for *memematematikakan* a phenomenon". *Mematematikan* could be interpreted as a model a phenomenon mathematically or building a mathematical concept of a phenomenon. De Lange (in wijaya, 2012) divides mathematical into two, ie mathematical horizontal and mathematical vertically. mathematical horizontal related to the process of generalization (generalizing). the process of mathematical horizontal begins with the identification of a mathematical concept based on the regularity (regularities) and relationships (relations) are found through visualization and schematization problem. mathematical vertical is a form of process formalization (formalizing) where the mathematical model obtained on horizontal mathematical form the basis for the development of a more formal mathematical concepts through a mathematical process vertically.

Gravemeijer (1994:93) describes the mathematical processes as shown in Figure 1.

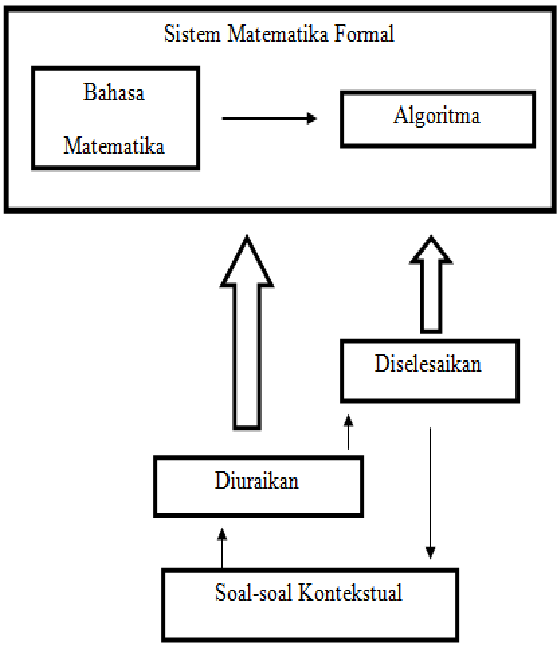

Figure 1. Matematisasi Horizontal and Vertically

In mathematical horizontal, learners langing from contextual issues, trying to decipher the language and symbols that made their own, then solved the problems. In this process, each learner can use in their own way which may be different to others. In mathematical vertical, we also started from contextual issues, but in the long run we can develop specific procedures that can be used to solve similar problems directly, without the help of the context.

In RME, the mathematics is viewed as a human activity (human activity), so the learning activities carried out by using a real context and appreciate the ideas of learners in working on mathematical problems. Gravemeijer (1994), suggests three principles associated with Realistic Mathematics Education (RME), namely:

a. Rediscovery under guidance (guided reinvention) and mathematical progressive(progressive mathematization).
b. Didactic phenomenology (didactical phenomenology).

c. Development models (self-developed models).

Simon (1995) states that "Hypothetical learning trajectories are defined by researcher developers as goals for meaningful learning, a set af tasks to Accomplish Reviews those goals, and a hypothesis about thingking students and learning". Based on these opinions in mind that HLT is composed of three components, namely the learning objectives for meaningful learning, a set of tasks to achieve these objectives, and hypotheses about how students learn and how learners think. The purpose of learning is meant here in the form of understanding a concept or solve mathematical problems.

According to Bakker (2003) studied the *Hypothetical Learning Trajectory* (HLT) to the concept of local learning proposed by Gravemeijer. Research design HLT related to the planned cross-learning and the *Local Instructional Theory* (LIT). According Gravemeijer (in Wijaya, 2008), LIT is a theory that provides an overview description of the learning flow for a specific topic. Learning trajectory plan contains allegations made and the teachers are expected to get a response from the learners for each stage in the learning trajectory. Allegations were made on the basis of a planning meeting each instructional activity called the trajectory plan learning (Gravemeijer, 2004).

Plans load learning trajectory the allegations made and the teachers are expected to get a response from the learners for each stage in the learning trajectory. According to Hadi (in Nurdin, 2011), *Hypothetical Learning Trajectory* is alleged a designer or a researcher about the possible course of learning happens in the classroom when designing learning. Because it is hypothetical of course is not always true. In fact there are many wrong because what happens in the classroom is often unpredictable. Once the researchers (in this case the designer) to test, obtained the actual learning path, it is called with the learning trajectory.

For its operations, the learning trajectory included in the RPP and LKPD. In Permendiknas No. 41 of 2007 on Processing Standards explained that Rencana Pelaksanaan Pembelajaran (RPP) is a plan that describes the procedures and organization of learning to achieve the basic competencies specified in Content Standards and have been outlined in the syllabus. RPP is used as a guide for teachers in the learning process. RPP contains three components in the groove of learning ie learning objectives, a set of activities or steps to be taken to obtain a goal, and hypotheses about how students learn and think. In formulating the flow of learning, first defined learning objectives outlined in the sub-sub-objectives. In designing learning activities, learning groove plan contains allegations of activities that will be carried learners and anticipations of the response given learners for each stage in the trajectory of learning to do.
In the process of learning, RPP assisted by the use Lembar Kerja Peserta Didik (LKPD). Generally Majid (2013: 371) says LKPD a learning tool as a complement or a means of supporting RPP. Lembar Kerja Peserta Didik is a sheet of paper that contains information and questions that must be answered by learners. Lembar Kerja Peserta Didik facilitate students in learning by using contextual issues that are often encountered in daily life and rediscover the concept through the guidance of teachers. It aims to develop problem solving skills of learners.

Most of mathematics education experts said the problem is a question to be answered or responded. However, they stated also that not all questions will automatically become a problem. A question would be a problem only if the question implies a challenge (challenge) that can not be solved by a routine procedure (routine procedure) which is already known to the perpetrator.

According Sumarmo (2010: 5), solving mathematical indicators are as follows:

a. Identify the elements that are known, were asked, and the adequacy of the required elements.
b. Formulate a mathematical problem or to develop mathematical models and presents a problem mathematically in various forms.
c. Implement strategies to solve various problems develop problem-solving strategies.
d. Explain or interpret the results as a problem.
e. Using mathematical significantly.

Indicators of problem-solving research that has been done is focused on the indicators a, b, c, and d.

METHOD

This study was designed using the research and development of version Gravemeijer Cobb. Plot development study was conducted in three phases of the implementation of the research that is preparing for the experiment (preparation), conducting the experiment (the implementation phase), and retrospective analysis (step analyst retrospective) During the preparation stage instructional theory formulated local or *Local Instructional Theory* (LIT). The study begins by reading and studying the literature related to the topic of Pythagoras's theorem in the form of journals and books as a source book to gain insight into the learning trajectory topic PythagoreanTheorem. LIT will be done is still in the form of grooves plan to study or *Hypothetical Learning Trajectory* (HLT). Instruments used in the form of HLT, RPP, LKPD, and about problem solving skills validated by five experts math. Validation is done by filling out the sheet validation and discussions with experts in mathematics. Validation results and discussions with the validator obtained a valid instrument.

During the implementation phase the tests in two cycles. The first cycle is a small group trial. Small group test conducted on six learners. This cycle aims to see how the design can work. Furthermore, the design can be evaluated and improved for the next cycle. The second cycle is the teaching experiments conducted in real class. In the analysis phase retrospective analysis whether HLT already planned to run in accordance with what is expected. The main objective at this stage is to contribute to the development of HLT in supporting the students understanding of the material PythagoreanTtheorem. At this stage of the retrospective analysis views the validity, reliability, practicalities, and the effectiveness of the product. The validity of the instrument was obtained from the results of the validation performed mathematician. Validity analyzed quantitatively. Reliability and effectiveness of learning trajectory analyzed qualitatively. learning trajectory can be said to be reliable if learning trajectory can bring learners in the intended direction and is said to be practical if learning trajectory can be used easily in accordance with the steps that have been designed and developed. Furthermore, the effectiveness of the learning trajectory seen through the pre-test and post-test. The learning trajectory practical to say if it can improve problem-solving abilities of learners. The effectiveness of learning trajectory analyzed quantitatively.

Data collection instruments include video recordings, field notes, documentation in the form of worksheets learners, and the pre-test and post-test.

RESULTS AND DISCUSSION

In this chapter, described the research results that have been obtained from the study plot development Pythagorean theorem of topic using RME approach to practice problem-solving ability of students of class VIII MTsN Lubuk Buaya Padang.During the preparation stage to do the assessment of literature about how to teach Pythagorean theorem of topic. Studied literature in the form of journals and books as a reference in teaching the topic of Pythagorean theorem. The book is used as literature is a book Teacher's Guide-Looking for Pythagoras of the book Connected Mathematics at Michigan State University. The Learning Trajectory focused on the development of understanding and problem solving skills of learners. The results of plot development study that has been done stating that the activity has been designed can direct learners to understand the Pythagorean theorem concept of informal stages to formal stages. Based on the analysis of literature, then designed Hyphotetical Learning Trajectory (HLT) Pythagorean theorem of topic for class VIII SMP as shown in Figure 2.

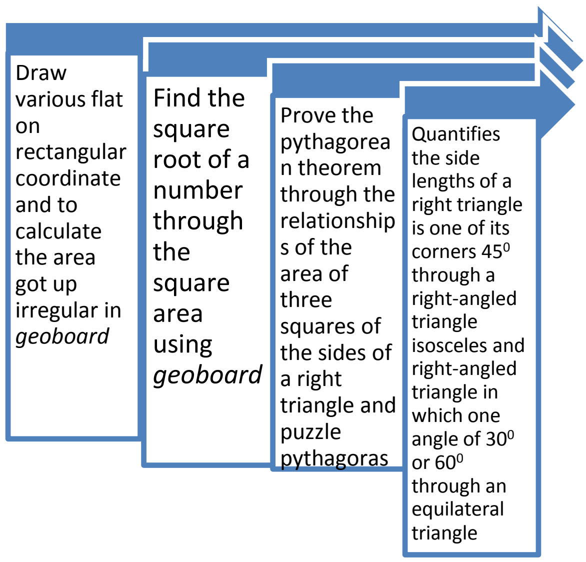

Figure 2. Design Learning Activities

The following sections describe each HLT used to achieve the objectives that were defined as shown in Figure 2.

a. Activities of draw various flat on rectangular coordinate and to calculate the area got up irregular in *geoboard*

Activities undertaken beginning with understanding the contextual problems is through the context of Plan Preparation Garden using maps created imaginary city by Airin is ASPAL city. From the context of the learners were told to create forms the park in the form of a square, rectangle, right-angled triangle, parallelogram and rhombus with through two point coordinates given that the corners of the wake to be drawn and if it is connected to form a line or side which is skewed (not vertical or horizontal). Learners try to describe and write down the coordinates of the point that they get. It is aimed at learners can distinguish four forms of flat wake if given one slanted sides. The next activity, students calculate the area of irregular wake on geoboard of the problem is given. This trains the students calculate the extent of, the last of learners draw wake specified extent on geoboard provided. The goal is to train the students calculate the area of irregular flat wake. And at the end of the students present what they get and make conclusions. They conclude how to calculate the area of irregular,

b. The activity of finding the square root of a number through the square area using geoboard

Activities were carried out at the start with the students draw a square on geoboard 5x5 as much as possible with widely different, and calculate the length of each side of the square which has been taken.from this activity learners can determine the length of the square to the side of the flat, especially side sloping. To better understand it continued with the next event, which focused on the sloping side obtained through the tilted square shape. Here students will find the form of the square root of a number. The next learners try to draw the line as much as much her on geoboard and calculate the length of the line. It aims to train students to be able to calculate the length of the line is sloping. At the end of the activity, the students presented the results of their discussions.

c. Activity of proving the Pythagorean theorem through the relationships of the area of three squares of the sides of a right triangle and puzzle Pythagoras.

Activities undertaken begins by recalling the students seitiga elbows, then gave the term on three sides. Furthermore, the students were told to describe some pictures of a right triangle with the known length of 2 pieces side. Then students will calculate the area of each square on all sides of a right triangle, whose goal is the students discover the Pythagorean theorem through the relationship of the third area of the square. Furthermore, to further strengthen the results obtained from previous activities, learners play puzzle Pythagoras. With this puzzle is expected that learners can understand. Furthermore, the students presented the results of their discussions to reach an agreement. Once they understand the students are given a picture of a right triangle and the length of two sides, no longer using geoboard. Here learners are expected to calculate the length of one side of a right triangle using puyhagorean theorem. Once students understand the Pythagorean theorem, the next matter is the opposite Pythagorean theorem and the Pythagorean triple with a given problem, the end of this activity is the students summarize what they have gained from understanding the concept of the Pythagorean theorem, inverse and triple Pythagorean.

d. Activity quantifies the side lengths of a right triangle is one of its corners 45^0 through a right-angled triangle is isosceles and right-angled triangle in the which one angle of 30^0 or 60^0 through an equilateral triangle

This activity is the final activity that once students understand the concept of the Pythagorean theorem, learners find a comparison side-by-side in a right triangle special, namely triangle isosceles (one corner, 45^0) and a right-angled triangle whose one angle 30^0 or 60^0. the activities are to find a comparison of the sides in a right triangle isosceles (one corner 45^0), learners are given a picture of some triangle isosceles with unknown long one leg of the triangle, then the participant students follow the steps dberikan activities so that learners will concludes comparison side in a right triangle isosceles (one corner, 45^0). The same was done to find a comparison of right-angled triangle whose one corner 30^0 or 60^0, students are given a picture of some unknown equilateral triangle with one of the long sides. Furthermore, students follow the steps to be taken that in the end the participants find comparisons for right-angled triangle whose one corner 30^0 or 60^0. Furthermore, the students presented the results of discussions they earn. At the end of the activities the students try to solve word problems related to the material being studied.
HLT and LKPD validated by 5 people validator. HLT validation results are presented in Table 1.

Table 1. Results of Validation HLT

	Aspek yang Dinilai	Rata-Rata	Kategori
1	Isi	3,10	Valid
2	Bahasa	3,10	Valid
Rata-Rata Validitas		3,10	Valid

The results of the validation aspect of the contents shows that the accuracy of the activity in each meeting that leads to the discovery of the *Local Instructional Theory* (LIT), *Hypothetical Learning Trajectory* (HLT) already contains learning objectives, the activities of learners, the alleged answer learners and anticipation by the teacher, the activity of each meeting starting from mathematical horizontal (informal) and followed by problems with realistic that leads to mathematical vertical (formal) is correct, the question is appropriate to introduce a mathematical concept, presentation materials coherent and systematic, HLT is based on the principles of RME, activities designed already right to encourage learners to acquire knowledge independently, and allocation of time in each meeting diracang own right. The results of the validation aspects of language indicates that the grammar used is correct, the language used in accordance with the level of understanding of students, the language used communicative phrases used by effective, easy to understand, and does not pose a double meaning.

LKPD validation results can be seen in Table 2.

No	Aspek yang Dinilai	Rata-Rata	Kategori
1	Isi	3,10	Valid
2	Bahasa	3,20	Valid
Rata-Rata Validitas		3,15	Valid

The results of the validation aspect of the contents shows that the material in accordance with SK and KD, LKPD was right in directing principles of *Realistic Mathematics Education* (RME), sequence learning activity has the potential for activity mathematical, activities mathematical horizontal (informal) and mathematical vertical (formal) are appropriate, activities meaningful learning, LKPD in accordance with the principle of RME, steps in LKPD encourage learners to acquire knowledge independently, learning activities in accordance with the allocation of time designed in every meeting, learners are actively involved to formulate concepts through problem solving, activities learners in LKPD encourage interaction between teachers and learners and learners with participants didikdan link between the material that one with any other material. Furthermore, the results of the validation aspects of language indicates that the grammar used is correct, the language used in accordance with the level of understanding of students, the phrase used is effective, the language used communicative phrases used by effective, easy to understand and does not give rise to a double meaning, as well as instructions and directives are clear. RPP validation results obtained by an average of 3.2 with a valid category, which is validated by the validator 4 which is 3 lecturers of mathematics and 1 math teacher.

During the implementation phase to test the small group and large group test. The trial results showed that the flow of small groups can work well with the learning objectives. Obstacles encountered in small group trial fixed for trial conducted in large groups.

At this stage of the retrospective analysis, judging the validity, reliability, practicalities, and the effectiveness of the product. Based on the triangulation of data and the validation results by 5 people validator is 3 math professor, one lecturer Indonesian and 1 math teacher obtained a valid learning groove. Furthermore, based on the triangulation of data obtained were analyzed qualitatively groove reliable and practical learning. learning trajectory said to be reliable because it is can bring learners in the intended direction. learning trajectorycan said practical because the learning trajectory can be used easily in accordance with the steps that have been designed and developed. At the end of the learning at each meeting, the teachers together learners reflect on the extent to which the implementation of what they have learning trajectory. From the discussion with the observer concluded that teachers should provide different treatment in each group due to the ability of each group is not exactly the same. There are groups who can perform activities in LKPD directly because no member of the group who knew and there are some groups who need more guidance from the teacher in providing direction. Teacher directives given in the form of a very probing question affect the continuity of discussion. Teachers need to add variations in anticipation of the problems found learners. In general, the large group trial did not need a big change for most of the problems encountered in large groups is also found in small groups. Thus, problems were found has been first anticipated on the basis of experience when conducting small group trial. HLT results in a large group trial will then become the *Local Instructional Theory* (LIT) as the end product of this research.

The effectiveness of learning trajectory can be seen from the pre-test and post-test. Based on the values obtained by learners, obtained information that learners who pass are 25 people of all learners who are 32 people with a minimum completeness criteria (KKM) is 80. This value is processed using percentage techniques mastery learning outcomes. Percentage of students learning completeness reached 78%. This shows that the learning path that was developed effective to develop problem solving skills of learners. In addition, the test results of students can be seen that the problem solving ability of students began to develop after studying with the learning trajectory that has been designed.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings and data obtained in this study, it can be concluded that:

1. This research has produced instructional design in the form of *Local Instructional Theory* (LIT) are valid, reliable, practical, and effective.
2. The potential impact the learning trajectory is that it can enhance the problem solving abilities of learners. Percentage of students learning completeness reached 78%.

Based on the research that has been done, the researchers suggest several things, among others:

1. Flow study with RME approach on the topic of Pythagoras's theorem can be used by teachers in teaching the topic of the Pythagorean theorem.
2. The flow study that was designed should be tested in other schools to see if the flow of learning is also effectively applied in other schools.
3. Flow study with RME approach on the topic of Pythagoreantheorem can be used as an example for other teachers or researchers in developing the learning trajectory on another topic. Improvements and modifications continue to be done, but taking into account the principle of RME.

4. Researchers can continue this study to look at the development or improvement of other mathematical abilities such as the ability of understanding the concepts, reasoning, and communication.

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THE ANALYSIS OF STUDENT'S ERROR ON COMPLETING TEACHER COMPETENCY TEST FOR PROSPECTIVE HIGH SCHOOL MATHEMATICS TEACHER

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Abstract

Previous research has developed the instrument of teacher competency test for prospective high school mathematics teacher. The developed instrument consists of two competencies, pedagogic competence and professional competence. Both competencies consist of 44 items covering 23 basic competencies. This study aims to determine the type of errors, to describe the location of error and to describe the basic competence which many students make mistakes on solving problem of competency test of prospective high school mathematics teacher in mathematics education Department University of Riau. This research is descriptive qualitative. The subject of this study is the students in Mathematics Education on third grade (sixth semester) University of Riau. The data was collected by using test method. After all of the data such as question items and the answer of students were collected, then the data were analyzed. The data analyzed showed that the most widely error type which is performed by students is the conceptual errors (33%). Meanwhile the location of error is caused because the students misunderstood the question. On pedagogic competence, the basic competence of approach, strategy, method and technique learning are the difficult subject with the level of completeness items only 9,667%. While on professional competence, the basic competence of mathematical statistics is the difficult subject with the level of completeness items only 12,903% among the other basic competencies.

Keywords :*Error analysis, teacher competency test*

INTRODUCTION

The quality of mathematics learning in Indonesia is still low. It can be observed from the survey of Program for International Student Assessment (PISA) in 2012. The ranking of Indonesia was 64 from 65 participant countries of its survey on mathematics literacy. There are several factors that can influence the learning process. One of them is the factor of teacher. Teacher is an educator and having a major role on achieving the goals of national education.

The goal of national education is educating the live of nationand developing the Indonesian as the human who have faith and piety to God, having good attitude, having knowledge and skills, having physical and spiritual health, independent and strong personality and having responsibility (Government regulation, Law No. 20 Year 2003). To achieve the educational goals, it is required teachers who master all teacher competences. The competences consist of pedagogical, personality, social and professional. At state in Law No. 14 year 2005on Chapter IV about teachers and lecturers stated that the teacher must have academic qualifications, competence, teaching certificate, having physical and mental health, and having the ability to achieve the national education goals. The qualifications and competency of teachers are verified by their professional certificate as the professional proof of teacherformal recognition.

Teaching certificate was obtained through the certification of teachers. This certification program has been implemented since 2007 after the publication of National Education Minister Regulation No. 18/2007 about the certification of teachers. The teaching certificate was obtained after teachers passed on Teacher Competency Test (TCT). In the study of YenitaRoza(2015), it has been developed an instrument about teacher competency testing for prospective mathematics Senior High teacher. Based on the obtained research data, the average score of teacher competency testing for prospective mathematics Senior High teacher tested on the third level math education students is 53.45, while the expected standard is 70.

The data showed that there are still many college students having low score. The students have difficulties on learning and solving the teacher competency test. These difficulties lead to error on solving problems of teacher competence test. One way to find out the mistakes which was done by the college students is by identifying their errors on solving teacher competency test. The errors of students need to be identified in order to determine what kind of mistakes made by the students and to determine the material which students made many mistakes. The error can be reduced when solving the same problem.

Based on the background of the problems, the formulations of problem are: (1) What kind of mistakes done by the students on solving teacher competency test for prospective mathematics Senior High teacher?; (2) Where is the common mistakes made by students on solving teacher competency test for prospective mathematics Senior High teacher?. Thus, this study aims to determine the type of error and where the error which are done by students on solving teacher competency test for prospective mathematics Senior High teacher.

LITERATURE REVIEW

1. Teacher Competence Test

Teacher competence test is a test that is performed to determine the condition of competence mastery of a teacher. The tested competences are pedagogical competence and professional competence. Teacher competence test should be followed by all teachers in both positions of teachers already certified or not, both public and private school teachers, civil servant teachers and non-civil servant teachers. Its implementation involves various institutions, such as BPSMPK-PMP, LPMP and District/City Education Service in order to make all the institutions having the same understanding about the mechanisms of teacher competence tests implementation in 2015. Teacher competence test consists of the beginning competency test for uncertified teacher and teacher competency test for certified teachers.

Technical implementation of teacher competence test in 2015 will be implemented in two ways: online systems and manual systems. The manual system will be implemented in district/city that does not have a device to comply the online system requirements, because Indonesia has big areas and not all of the district having electricity, so that it should be implemented by using the manual system (paper pencil test).

The principle of TCT material is the basic competency on subjectand pedagogic. The competency of subject which is tested according to the subject of certification for certified teachers, meanwhile the uncertified teacher (participants of Beginning Competency Test) in accordance with the academic qualifications of teachers. The test instruments for teachers at level junior high school, senior highschool and vocational high school is distinguished by the assumption that the profession development and the assessment of teacher performance based on the task place.

The instrument development of the BeginningCompetency Test (BCT) consists of blueprints and question items. The problemsof TCT are developed by experts with the form of objective test questions with option of four multiple-choice answer. The composition of the test instrument is 30% pedagogic competency and 70% professional competencywith the time allocation is 120 minutes and the number maximum question is 100 items. For the blind teachers, the time allocation is 180 minutes.

The tested aspects on teacher competency test consists of two competencies, such as pedagogic and professional competence. Pedagogical competency include (1) identifying the characteristics and potential of students, (2) mastering the learning theory and principles of effective learning, (3) planning and developing curriculum, (4) implementing effective learning, (5) assessing and evaluating learning.

The tested professional competency of the tested include (1) mastering of the material, structure, concept and mindset scientific that support the subjects of teaching, (2) developing the profession through reflective action, (3) having consistency on mastering the teaching materialbetween content and performance.

2. The error on solving problem

KarimNakii (1999) classified three types of errors on solving mathematical problems, such as: (a) misconception which are created by students on interpreting the concepts, formulas, operations or incorrect on its application; (b) operating error which made bythe students because having error onsolving arithmetic operations/algebra and its properties; (c) careless mistake which made by students because forgetfulness, but basically these students know how to solve it.

Ashlock (1994) classifies the calculation errors on solving mathematical problems into three basic categories, namely (a) the wrong operation, the student using the inappropriate operations when trying to solve a math problem, (b) error on computing or facts, students using appropriate operations but made a mistake involving the basic facts, and (c) wrong algorithm, students using the appropriate operation but make not a number of errors of fact in one or more steps implementation strategy or choose the wrong strategy.

According NoehiNasution (2004), the student error consist of misconceptions, procedural errors and computational errors. Misconception is meant here is the fault determining the formula to be used in solving mathematical problems. Error procedure is meant here is the fault of the steps performed by students in obtaining the truth of the answers / solutions to problems. While errors in computing is a calculation error or manipulate the operation done by the students to solve the problems

RESEARCH METHOD

This research is descriptive quantitative research. This research was conducted in the even semester of academic year 2014/2015. The population of this study was prospective teachers of mathematics Mathematics Education University of Riau. The sample is the student as prospective teachergeneration 2012. The research instrument used in this study is teacher competency test instruments for prospectivemathematics senior high teacher, which consists of 15 pedagogical competency questionsand 29 professional competency questions. Data needed in this research is the teacher competency test data for prospective high school math teacher. Data analysis technique used is to calculate the percentage of error and classify the types of errors.

Result and Discussion

Based on the test results showed that the average score of students on teacher competency testing for prospective mathematics senior high teacher is 53.45. The results of these test can be seen in the following table 1.

Table 1. The result of teacher competency test for prospective mathematics senior high teacher

Competence	Mean
Pedagogic	62,366
Professional	47,497
Mix	53,45

From the above table, it can be seen that the score oftest competency teachers for prospective mathematics senior high teachers is still low. The pedagogical average student is 62.366 and the average value of students on professional competence is 47.497 and overallthe average score of students is 53.45.Meanwhile, based on basic competencies, the value of the competency of teachers for mathematics teacher candidates obtained can be seen in table 2 below

Table 2. Level of completeness of teacher competency test for prospective mathematics senior high teacher

Basic Competence (BC)	Level of Completeness (%)	Basic Competence (BC)	Level of Completeness (%)
BC 1	19.355	BC 13	80.645
BC 2	35.484	BC 14	83.871
BC 3	70.968	BC 15	48.387
BC 4	70.968	BC 16	32.258
BC 5	9.677	BC 17	47.214
BC 6	96.774	BC 18	55.645
BC 7	45.161	BC 19	50
BC 8	77.419	BC 20	50
BC 9	70.968	BC 21	40.860
BC 10	64.516	BC 22	12.903
BC 11	70.968	BC 23	61.290
BC 12	90.323		

Based on table 2 above can be seen that the pedagogic competence, level of difficulty of the most difficult problems found in basic competence 5, namely to the basic competence Determining an appropriate learning experiences to achieve the learning objectives of teaching. In this basic competence, level of completeness matter of only 9.667%, while the professional competence. the difficulty level of the most difficult problems found in 22 basic competencies, namely basic competence to master the fundamentals of mathematical statistics. In this basic competence, level of completeness matter of only 12.903%.

Basic competence 1 to 15 core competencies are basic competence in pedagogic. Problem on pedagogical competence include identifying potential learners, identifying learning difficulties learners, applying various approaches, strategies, methods and techniques of teaching, principles of curriculum development, as well as the utilization of information technology in learning.

While the basic competencies 16 to 23 basic competence is the basic professional competence. about the number of professional competence includes the theory, algebra, abstract algebra, geometry, statistics, calculus, trigonometry and probability.

Based on the kind of mistakes made by the students can be seen in Table 3 below

Table 3. Type the mistakes made by students in teacher competency testing for prospective teachers

competence	Type of error	
	Conceptual(%)	Process(%)
Pedagogic	37.634	0
Profesional	32.687	19.816
Mix	33.489	13.061

Based on the above table it can be seen that the types of errors that most students do is kind of a misconception of 33.489 % . While processing errors amounted to only 13.061 % . Most of the fault location in which students are students misunderstood the question

CONCLUSION

1. Determine the study experience for get the goal of learning in pedagogic competence is subject which is exceptionally difficult with the level of completeness items only 9.677%
2. Mathematical statistics basic competence inprofessional competence is subject which is exceptionally difficult with the level of completeness items only 12.903%.
3. The highest error made by student's is in conceptual error.

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Learning Media Development at Mobile-based Calculus Course in Higher Education

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Abstract

Changes in technology make changes in education. Implementation of learning in Higher Education emphasize the process of learning the scientific approach and Project Based Learning (PBL) and thus create the Student Center Learning (SCL). Optimal utilization of the technology yet in the process of lectures, so the importance of development of instructional media Calculus as a supplement in learning and creating self-learning within students. Research Methodology Research & Development (R & D) use models ADDIE (Analysis, Design, Development, Implementation and Evaluation). At this stage of the development of multimedia development model proposed by Luther Sutopo used consisted of: (1) The concept, (2) Design, (3) collect material, (4) Assembly and (5) Distribution. Development of mobile-based media in the course of Calculus comprises: intro menu, the main menu, evaluasi. Test of materials and products media in the form of validity, practical and effectiveness have shown that the use of multimedia feasible at higher education.

Keywords:*Project Based Learning, Student Center Learning, Calculus, Multimedia, Model ADDIE*

INTRODUCTION

Mathematics without exercise then lead the students do not understand the basic concept of solving a case. Exercise is repeatedly accompanied by discussion questions will facilitate students' understanding of mathematics learning process. Curriculum 2013 using saintific approach to learning and learning model used Student Center Learning (SCL), students are more active in learning and build their own knowledge through from which they are observed in the learning process so that the resulting new knowledge. Instructional media used in the learning process affects the formation of new knowledge to the students. Utilization of ICT in making instructional media present a case that has to be done. The difficulty of primary school students in solving mathematical problems that are sometimes in the textbooks they use there are several steps in solving mathematical problems that are not listed, so that from this it is necessary to be made a medium of learning mathematics ICT based mainly discussions of mathematical steps in sequence until results. Of these media students can be expected to repeat the study in which they want that is not limited by space and time.

LITERATURE REVIEW

The term means the overall design, structure, framework or outline, and the order or systematic activity. Addition, said the design can also be interpreted as a systematic planning process undertaken prior to action or implementation of an activity development. In a sentence, said the design could be used both as a noun and a verb. As a verb, design means a process to create and create new objects. As a noun, the design is used to describe the end result of a creative process, whether it materialized a plan, proposal, or the shape of a real object.

The term design (engineering) technology is actually taken from the environment. So do not be surprised if in the process of designing everything, more or less would be associated with the nuances of technology. Basically the design is a design pattern that became the basis of making an object, such as clothing, furniture, buildings, and others - others.

School exam the act of measuring the achievement of competence of learners conducted by educational units to gain recognition for learning achievement and is one of the graduation requirements of the educational unit. Subjects tested are the subjects of a group of subjects in science and teknologi.

Mathematics is a branch of logic that provides a systematic framework within which can be studied kuantitatif.2 ratio. mathematicians look for patterns, formulate new conjectures, and establish truth through rigid deduction from axioms - axioms and definitions-definitions corresponding. And according to Johnson and Rising mathematics are patterns of thought, patterns of organizing, proof that logic, mathematics is a language that uses terms defined carefully, clearly and accurately, with symbols and solid representation. More of a symbolic language of the idea rather than the sound.

So mathematics can be regarded as a mindset that is highly correlated with logic and symbols.Software used in the manufacture of medium of learning in mathematics in this study: Adobe Flash CS6, Cool Edit Pro, and Photoshop.

Storyboard has a very important role in the development of multimedia. Storyboards are used as tools in multimedia design stage. Storyboard is a description of the rules of the story and including taking the angle of the drawing, dubbing and special effects. Storyboards are graphic organizers, for example, is a series of illustrations or images displayed in sequence for the purpose of visualizing the beginning of a file, animation, or interactive media, including interactivity on the web.

User Interface (user interface) is part of a program that interaction with the user (user). When users enter instructions through input devices, such as keyboard, mouse and others, then the program will evaluate and provide answer. So User Interface is a communication mechanism between the user (user) with the system.

METHOD

The method used in this research is the Research and Development (R & D). Research and Development (R & D) is the research methods used to produce a specific product and test the effectiveness of the producttersebut.In R & D there are three stages of research to be done: 6 (1) Validation Test, test or validation expert, conducted with respondents experts designing models or products. This activity is conducted to review the initial product, provide feedback for improvement. (2) practicalities, after a validated assessment instrument and the results are declared valid with some revisions, the next step is done prektikalitas. From the description and analysis of data based on the observation, interview by a validator, the students' comments, showing the practicalities of instrument ratings on practical materials. (3) Effectiveness, Effectiveness is the fit between student learning outcomes. Based on these opinions can be said that the effectiveness of learning is a process that must be passed students to achieve learning outcomes. That is when whentujiuan reached, they must be questioned how far effectiveness. One way to measure the effectiveness is to determine path transfebilitas (ability to move) the principles learned. If the objectives can be achieved in a shorter time with a certain strategy of the other strategies, the strategy was efficient, kalukemapuan transfer information or skills learned bigger is achieved by a particular strategy dubandingkan another strategy, then the strategy is effective for the achievement of learning objectives.

In this study the authors use the model ADDIE. ADDIE is an acronym for Analisys, Design, Development, Implementation, and Evaluation. ADDIE Model is one of the instructional system design model showing the basic steps instructional system design simple and easy dipelajari.7Model ADDIE development consists of five main steps, namely; Analysis, Design, Development, Implementation, and Evaluation.

In this study the authors use the model of the development of multimedia version of Luther-Sutopo.8 According to Luther, multimedia development model consists of six stages: concept (pengonsepan), design (designing), collecting material (material collection), assembly (manufacture), testing (testing) and distribution (distribution). The sixth stage is not necessarily sequentially, in practice, these stages can exchange positions. Even so, the concept stage must be the first thing to be done.

RESULTS AND DISCUSSION

Design

a. Use Case Diagram

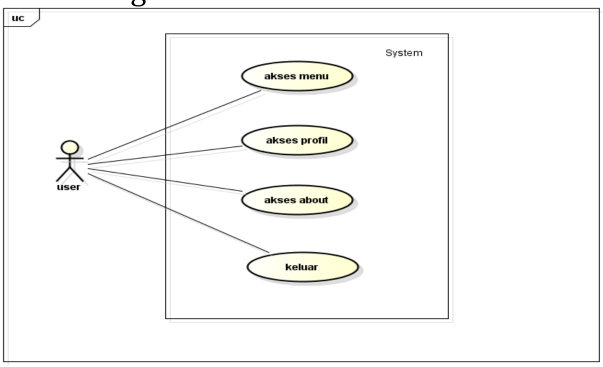

Figure 1. Use Case Diagram Formulas applications Calculus

b. Activity Diagram

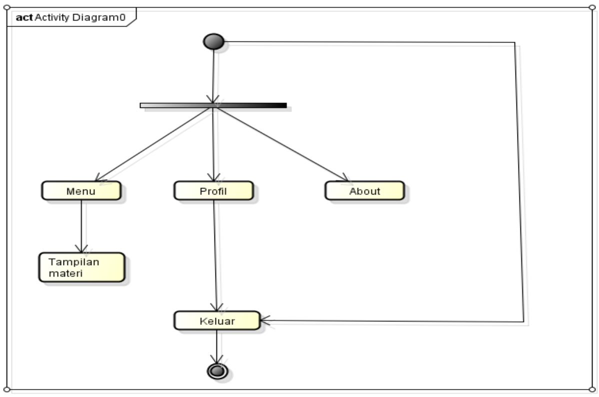

Figure 2. Activity Diagram Calculus Formulas

Assembly

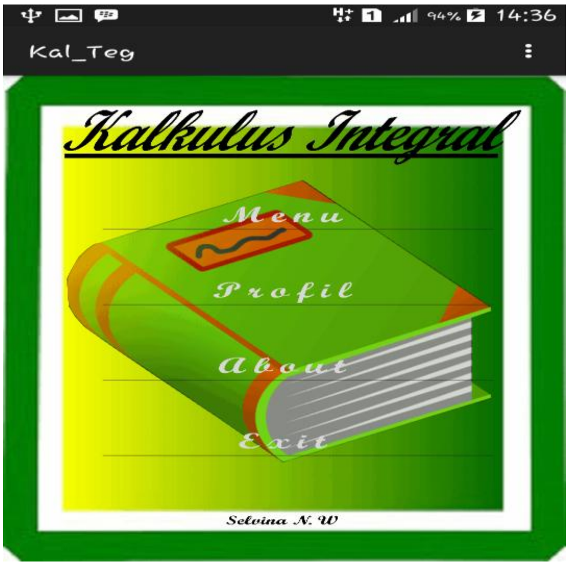

Figure 3. Design of output Splash Screen

Figure 4. Design of the application's main menu output

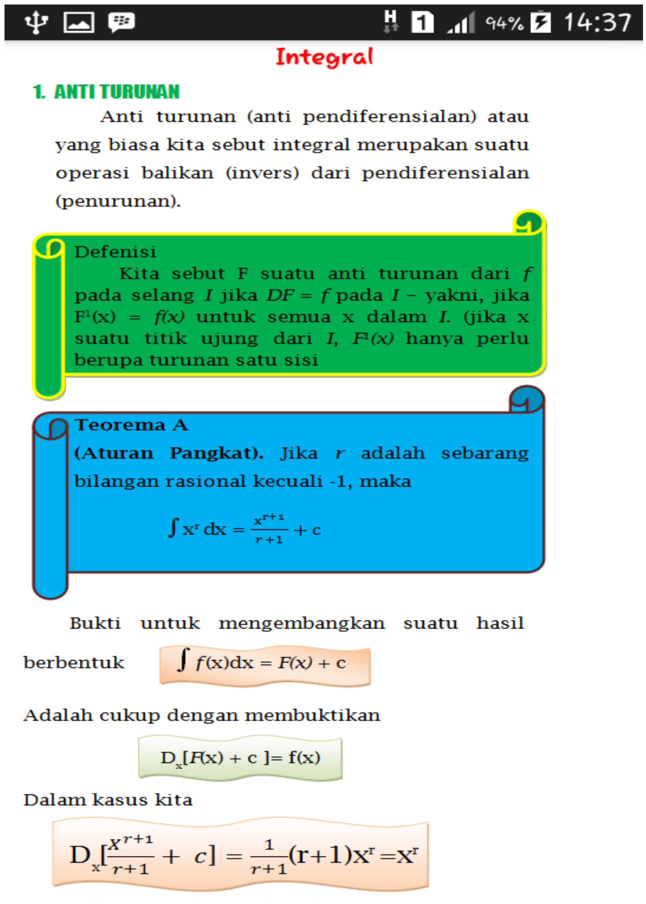

Figure 5. Design output menu

Figure 6. Design of output display integral material

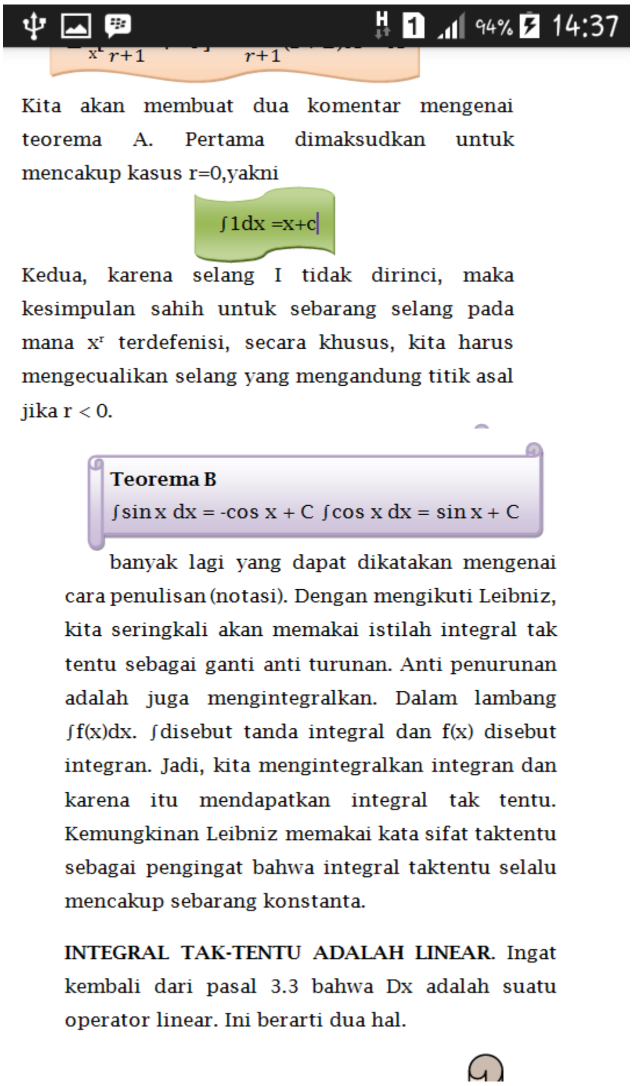

Figure 7. Design of output display integral material

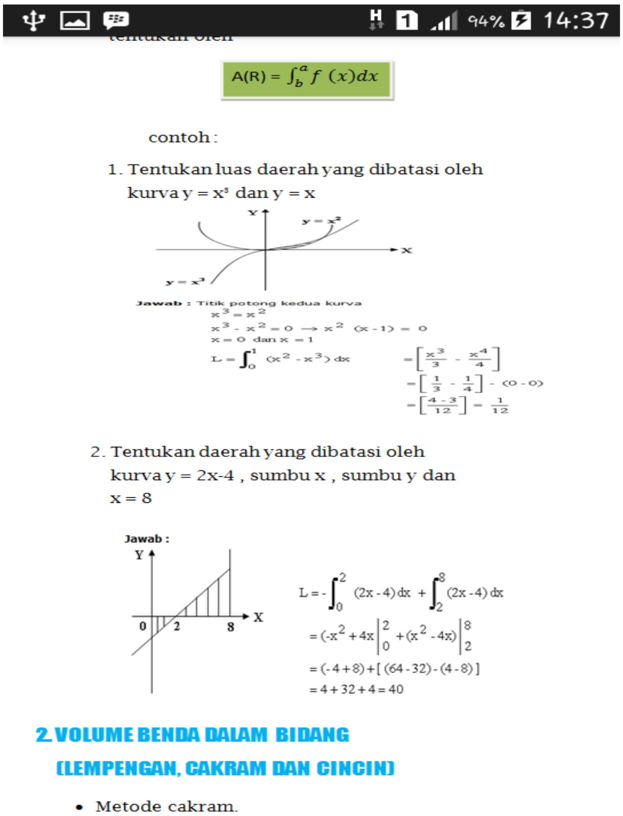

Figure 8. Design display output integral use of the material

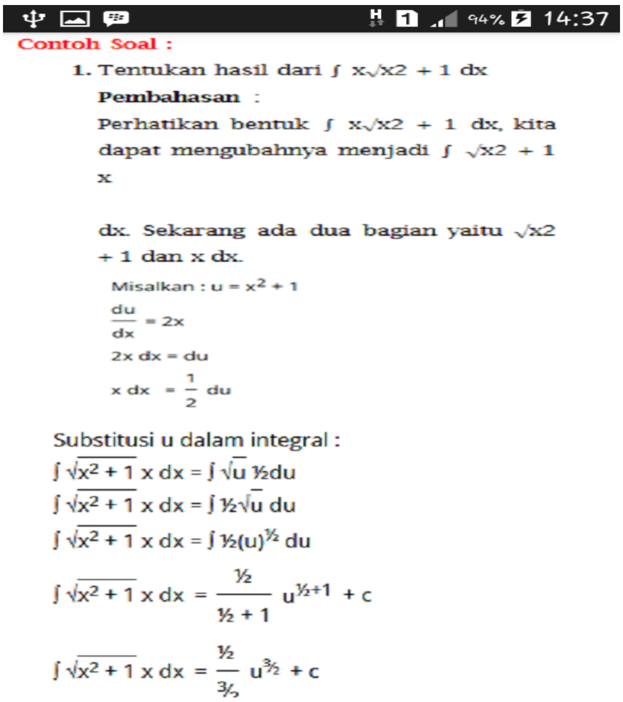

Figure 9. Design transcendent function display output material

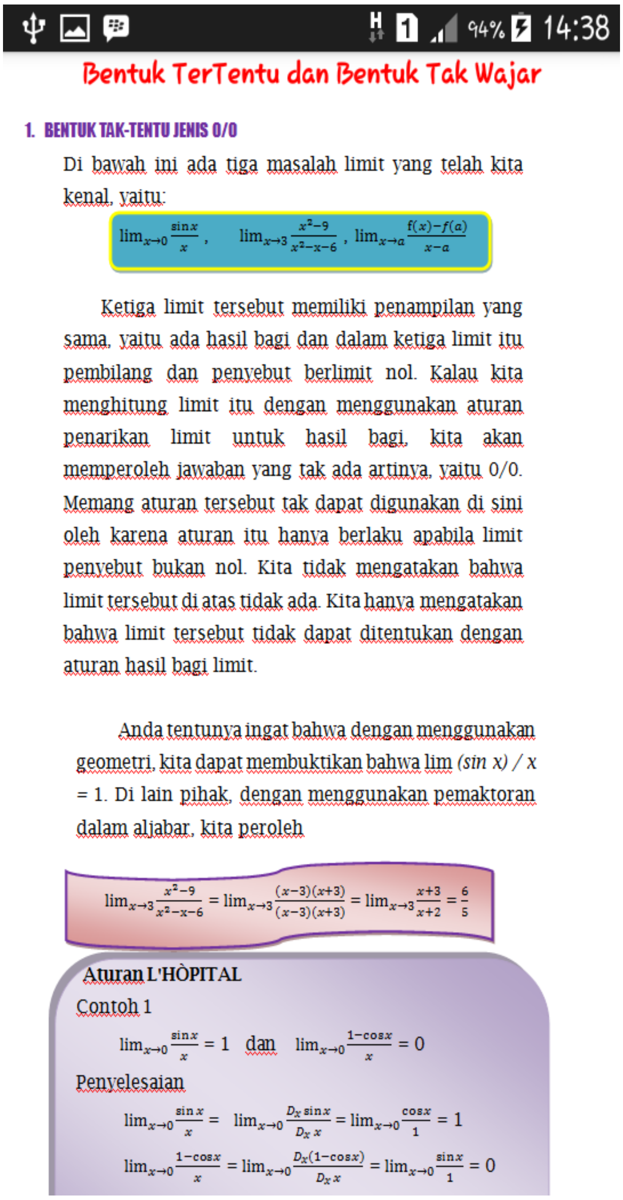

Figure 10. Design of display output material indeterminate forms and indefinite integrals

Testing

Based on the implementation of applications Calculus II formula has been done it can be concluded that these applications can be used and has produced output that had been expected.

The results of the validation sheet from the first validator such as the appendix of this thesis, the application of formula Calculus II getting final validation value 74.3%. The results of the validation sheet from the second validator getting final validation value of 92.4%. The results of the validation of the value of the third validator validation scored 85%. The end result of the value validator to four got validation 81.9%.

Results sheet practicalities of Mathematics Education student first, mobile learning design scored 85.5%. Results sheet practicalities of Mathematics Education student secondly, the design of mobile learning scored 98.2%.

Results sheets response effectiveness of the application of mobile learning has been the author distributed to the 15 students of Mathematics Education to get the value of 95.6%, 86.7%, 91.2%, 93.4%, 88.9%, 84.5%, 91.2%, 88.9%, 75.6%, 75.6%, 75.6%, 91.2%, 86.7%, 95.6%.

DISTRIBUTION

Based on the results of research and design that has been underway it can be concluded as follows: Calculus application design formula based on android using eclipse software luna version, this application is very practical to use and master program small applications that access current applications used on smartphones android.

CONCLUSION

Point of strength applications

a) The application has a simple and attractive appearance.
b) Calculus Master application is small and lightweight smartphone.
c) Use of the application is relatively easy to use.

Its application weaknesses

a) The material can not appear in the zoom.b)
b) There are no animation or video within the app calculus.
c) Not able to update online.

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LEARNING MEAN BASIC CONCEPTS USED IN GRADE V PSB

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Abstract

Mean is a part of learning statistics, which is one of the most important aspects of the scope of the mathematics and is a measurement of students' first encounter in school. The research aims to generate trajectories of learning that can help students understand the basic concepts of mean use of the Admission of The New Students (PSB) to approach Indonesian Realistic Mathematics Education (RME). Metodologi used in this study is the Design research consist of three stages, Preliminary Design, Preliminary and Teaching Experiment, and Retrospective Analysis that will discuss the cycle 1 Preparing for the experiment consists of Preliminary Design which is designing Hypothetical Learning Trajectory (HLT) and Pilot experiment trial or trials of HLT that has been designed that will produce a learning trajectory. Subjects in this study were students of class V SD Islam Az-Zahrah Palembang, amounted to 6 students with academic skills category, which consists of two low-ability students, two average-ability students and two two highly-ability students. Collecting data in this study were using video, observation, written tests, documentation and notes during the activities. The result of the research showed that Hypothetical Learning Trajectory (HLT) that has been designed using the context of the PSB with RME produced approach a learning trajectory that can help students understand the basic concepts mean.

***Keywords**: Mean, Design Research, PSB, RME*

INTRODUCTION

Mean is a part of learning statistics , which is one of the most important aspects of the scope of the subjects of mathematics in the education unit SD/MI. The average count is one of the concepts in the size of data concentration is defined as the equitable sharing (fairbshare) (Franklin and Mewborn 2007, Kader and Mamer, 2007). In some countries like the United States, Germany and Australia, students have learned on mean when they are in class four or five or ten years old (ACE, 1991; NCTM, 1989, 2000). In Indonesia, the new 2013 curriculum that teaches the concept of the mean or mean of the previous grade 5 curriculum from grade 6 (Kemmendiknas, 2013).

Teaching and learning process on mean mostly done by giving a formula directly without first learning about basic concepts and procedures are meaningful (meaningful) for students (Groth, 2006). Most teachers teach the concept of the mean in the traditional way , with a focus on calculations alone. They tend to follow the definition and the problems given in the textbooks without giving an opportunity to the students to develop ideas that they have. Teaching and learning process like this pose a low level of understanding so as to further cause students experiencing difficulties and mistakes in understanding the basic concepts of the mean.

According Batanero et al (1994) difficulties in learning statistics caused by several things such as the concepts they are studying, students' prior knowledge, as well as the methods or approaches used by teachers in teaching. It is aligned with Lestariningsih (2010) which states that the learning and teaching of statistics in Indonesia are generally centered on the teacher (teacher centered) without any effort to develop ideas or ideas of mathematics students through interaction or discussion. This makes students not accustomed to express ideas or discussions. Based on the above issues, we need a way that is interesting and meaningful for the students in learning the basic concepts of the mean so that they become more motivated to learn about both basic knowledge and concepts. Realistics Mathematics Education (RME) provides an opportunity to change the mathematics education in Indonesia. In RME, students are allowed to create their own ideas for solving a mathematical problem given, not only using the rules to get it done.

Ormulation Problems and Problem Solving Plan

Under the background of the problem in this study is whether the HLT (Hyphotetical Leaning Trajectory) that has been designed using the PSB PMRI approach can help students understand the basic concepts of the mean?

LITERATURE REVIEW

Realistic Mathematics Education (RME) is a theory of mathematics learning was first introduced and developed in the early 1970s in the Netherlands (Zulkardi, 2002). RME Freudenthal based on the idea that mathematics is a human activity, and students can not be seen as passive recipients of existing mathematics (Hadi, 2005). In Indonesia RME in adaptation and known by the Indonesian Realistic Mathematics Education (PMRI). PMRI itself can be regarded as RME versions of Indonesia because the concept is adapted to the culture of Indonesia and based on theory of RME (Sembiring, et al, 2010). PMRI implemented in Indonesia since 2001, developed by the Institute of Development PMRI (IP-PMRI) chaired Sembiring (Wijaya, 2012).

In the context PMRI or "real situation" is used as a starting point in learning (Zulkardi, 2002). Context is also used as a bridge to connect the student's knowledge of the informal stage to the stage of formal concepts. Learning math is done by directing students to use a variety of situations and opportunities to rediscover the concepts learned. According to Wijaya (2012) use of the word "realistic" is often misunderstood as a "real-world", ie the real world so many people who think that PMRI is an approach to learning math should always use everyday problems. The use of realistic word itself actually comes from the Dutch language "zich realism" means "to imagine" or "to imagine" (Van de Heuvel-Panhuizen, 2003). Van de Heuvel-Panhuizen (2003) explains, "realistic" not only shows the connection with the real world but rather more of an emphasis on the use of situation can be imagined by the students.

In PMRI significance of a concept becomes the main thing. This is in line with the opinion of Freudenthal (1991) stated that student learning will only occur if a knowledge learned meaningful for students. Meanwhile, a knowledge will be meaningful for students if the learning process is done in a context (CORD, 1999). Therefore, beginning with context, it is expected of a lesson (with PMRI approach) would be meaningful for students. Sembiring (2010) stated that learning with PMRI approach will have some characters, that students are more active thinking, Context and teaching material directly related to the school environment and student and teacher's role is more active in designing instructional materials and classroom activities.

MEAN

The mean is one of the concepts in the size of data concentration is defined as the equitable sharing (fairbshare) (Franklin and Mewborn, 200, Kader and Mamer, 2007). According to Cobb and Hodge (2002) mentioned that there are two important aspects that must be considered in the process of learning about the mean is calculated, namely: The ability of students to understand their position or role when learning concepts (students development of a sense of who they are in relation to concept). Effective data based on descriptions of students in need of problems that make sense and could be imagined by the students (effective data is based arguments in students requires realistic and legitimate problems and the data sets).

Furthermore Franklin and Kader (2010) states that the basic concept of the learning process on mean that must be contained in a series of activities on the path of learning are: Apportion the idea of a group of data (the nation of the fair share value for a set of discrete numeric data). Apportion also called the arithmetic mean (the fair share valueis also called the mean value). The formula to find the mean (the algorithm for finding the mean)
Here's an alternative to write the formula of mean:
Mean = (sum of all data) / (amount of data)
Discrete data is data in the form number (number) obtained from the counting or not counting measure (Sundayana , 2014). Because obtained by counting , discrete data will form the integers (no fractions) and rounding may only be 1 should not be more than 1. Thus, in this research data on the number of new students as context is a discrete data.

METHOD

The main objective of this study was to produce a learning trajectory that can help students understand the basic concepts of average use context Admission (PSB) to approach Indonesian Realistic Mathematics Education (PMRI). This study discusses only one cycle is discussed early stages of the trial HLT on the pilot experiment consisted of 4 activity.

DISCUSSION

Preliminary Design

This phase has resulted in an HLT tested at the stage of the Preliminary Teaching Experiment (cycle 1). HLT designed consists of four activities, each activity includes the kind of activity, the initial thought, the goal to be achieved, a description of the activity and conjecture students' thinking. The fourth activity is a) Identifying information about the new students who have signed up; b) Sort the number of students who have signed up on the first week until the last week of the registration; c) Determine the class for all new students so that each class of the same amount; d) Determine the mean formula. The following are activities HLT 1 tested at the Preliminary Teaching Experiment.

Preliminary Experiment teaching (Cycle 1)

During preliminary experiment teaching (first cycle) we examined the design of learning activities and instruction in the HLT first small group composed of six students. These students are students of class V SDI AZ-Zahrah Palembang. Sixth students can be categorized as having the capability of high, medium and low (respectively two children each category) based on teacher observations of student achievement. Researcher role of the teacher in cycle I. Observations along with an analysis of everything that happens during the preliminary teaching and conjectures made in learning activities are evaluated based on the findings to improve HLT.

Cycle 1 consists of four activities that are a) Identifying information about the new students who have signed up; b) Sort the number of students who have signed up on the first week until the last week of the registration; c) Determine the class for all new students so that each class of the same amount; d) Determine the mean formula. Of each activity described initial skills that must be possessed by the students. To determine whether the initial capabilities have been held by students, researchers gave the students some questions related to the initial capability. As a result, six students are given questions, four of the six students answered correctly, while remaining true answer 3 of 5 given problem. That means the initial capability already owned by the students. Such capabilities include, retrieve data, input the data into the table, and make distributions of all data. Furthermore, the following description of the activities during the first cycle.

At first we present the actual events that occurred during the small group and then compare it with the HLT on the retrospective analysis. We analyze how the implementation is a HLT activities to support the idea of students in developing basic concepts average. All the findings obtained during the first cycle be used as a basis for consideration improvement HLT HLT 1. Analysis of the application of cycle 1 is presented in the same order as the cycle 1. In conclusion, a discussion of the test results HLT provide answers to the research questions.

Activity 1 (Identifying information about the new students who have signed up)

In the first lesson, students are given a Student Activity Sheet which contains a discourse or story about a school that held a new admissions. First, students are required to understand the content of the discourse covering the opening when the new student enrollment, how many weeks the registration opened. Then the students recognize the information about the number of students enrolled in each week. Students have different answers tengtang duration of registration opened. Initially students to name 3 weeks old enrollment. Excerpt 1 shows the responses of the students in identifying new information about the student.

Researcher : "How many weeks a new student registration opened?"
Desti : "3 weeks".
Researcher : "Why 3 weeks 5 days Desti?"
Desti : "for 1 week consists of 7 days bu".
Researcher : What do the others? "
Kevin : "four weeks"
Researcher : "Why four weeks"
Kevin : "4 weeks because in the discourse of the week is not included,"
Desti : "oh yes bu 4 weeks"
Researcher : "Yeah right once on the discourse of the week are not counted. So the registration duration is 4 weeks ".

Citations 1. Digging data information

Furthermore, students count the number of students who have registered in each week both boys and girls. Unlike determines the length of enrollment, some students have almost the same answers. Excerpt 2 illustrates penenliti and student-student discussion.

Researcher : " From a discourse that you see now how many students sign up for the first week of ?"
Kevin ,Agung , Zein : " 9 male students and 11 female students" .
Researcher : "How Naswa group?"
Naswa : "6 boys and 4 girls" .
Kevin : "One bu, the first week of the 4th to the 9th?"
Naswa : "Yes ma'am forget"
Researcher : "Yes it's first week of the 4th to 9th, so the number of students enrolling 9 male students and 11 female students?"

Excerpt 2. Collect students who have already registered

After the students finished discussing the data in the first week, then the student determine the number of new students in the second week until the fourth week of registration.

Answer students at LAS

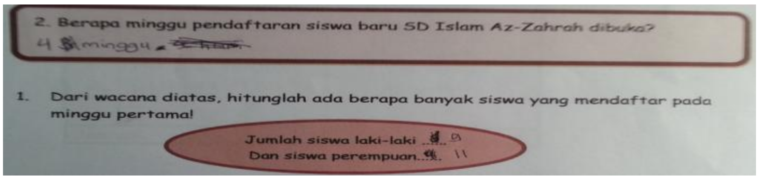

Figure 4.1 Naswa group, Dusti, and Dzaki

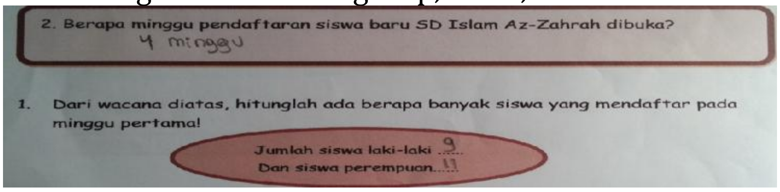

Figure 4.1 kevin group, Zeen, and Agung

Retrospective Analysis Activity 1

Based on information on the activities Identifying new students who have signed up at the beginning of the first, it appears students gave different answers in determining the length of the newly opened student enrollment. Meanwhile at the end of the first activities that the students count the number of students enrolled in each week. To determine how many weeks of activities open enrollment, from Citation 1 can know if Desti have differing opinions regarding the duration of enrollment with Kevin and other friends. He argues that the registration duration of 3 weeks. But after he read the discourse again, and discuss with other students like he already understood his mistake. Firm opinion delivered by Kevin, that the period of registration is 4 weeks for 1 week consists of 7 days and in the discourse Sunday is not counted because it is a holida .

Meanwhile, the second citation, the error in determining the number of students who enroll in the first week. Kevin group, the Supreme and Zein said there were 9 male students and 11 female students. While Opinions Naswa group, Dusti and Dzaki there are 6 boys and 4 girls. Pendafat group Naswadibanta by Kevin group with firm opinion that the first week of the 4th to the 9th After reading the discourse back Naswa group admitted his mistake. Furthermore, to determine the number of students the second week, third fourth danminggu registration of all students have the same calculation. Students did not have a difference of opinion at all in determining the number of male students and female students.

Answer of figure 4.1 was an error occurred, but after they read back discourse broke they realized that the answer wrong and correct his mistakes. While their answers are correct figure 4.2 in accordance with the answer Student Activity Sheet (LAS), ie there are four weeks of enrollment and the number of male students is 9 and 11. The female students so that students can be summed up all the student has answered correctly to dig up information about new students , Thus, according to the HLT, students can continue to sort the number of new students who have signed up for the activity 2.

Activity 2 (Ordering Number of Students Sign Up From Last Week First Week Registration)

In this activity students are given the opportunity to fill in the data tables of new admissions they have to count on every week. First, students add up how many students enroll on a weekly basis. Figure 4.3 shows the students doing the first week of counting the number of students.

Figure 4.3. Students count the number of students who enroll in each week

The number of students on a weekly basis derived from the first activity to go directly menjumlakan the number of male students and female students who have signed up .

Kevin : " The first week 11 plus 9 how much?"
Zien : " 20 students "
Kevin : " The second week 18 ditamba 12 ? "
Court : " 28 students "
Kevin : " rather than 30 students "
Zien : " the third week of 40 students
Kevin : " the fourth week how much?"
Court : " 35 students "

Excerpts 3. Calculate the number of students in each week

From the sum then the students enter the new student data into a frequency distribution table is provided in LAS. As Figure 4.4 below

No	UrutanMinggu	BanyakSiswa
Jumlah		

Figure 4.4 . Frequency distribution table should include students

Figure 4.5.students enter data into the table

While the final results of the students' answers can be seen in Figure 4.6 below

No	Urutan Minggu	Banyak Siswa
1	minggu pertama	20 siswa
2	minggu kedua	30 siswa
3	Minggu ketiga	40 siswa
4.	minggu keempat	35 siswa
Jumlah		125 siswa

No	Urutan Minggu	Banyak Siswa
1.	Minggu ke-1	20
2.	Minggu ke-2	30
3.	Minggu ke-3	40
4.	Minggu ke-4	35
Jumlah	4 Minggu	125

Figure 4.6 final answer in the data entry of new admissions to the order of weeks.

Retrospective Analysis Activity 2

Based on the events during the second activity, quantifies new students enrolling each week and enter data into the table according to the order of a week. students correctly enter data into the table. From the picture. 4.6 looks responses of the students in determining the number of new students and put it into a table.

In the case of summing the number of new students who needed only accuracy by students. Excerpt 5 line 4 indicates don’t examinecourt in summing male students and female students in the second week, but the mistake was immediately denied by Kevin clearly that the number of students who enroll in the second week is 30 students. Therefore we can conclude all students have answered correctly in summing the number of new students and insert into the table. Thus, according to the HLT, students can continue to define a class for all new students at the three activity.

Activity 3 (Define New Classes For All Students)

In this activity students will find ways to determine the number of new students in each class are available. On the problems of the LAS is given of new student data that have been included in the table and are available to the school grade five. Students are required to determine the number of students in each class on the condition of male students and female students in each class should be flat.For that provided a box for modeling classes and two different colored paper as a substitute for male students and female students to male students for the yellow and pink female students.

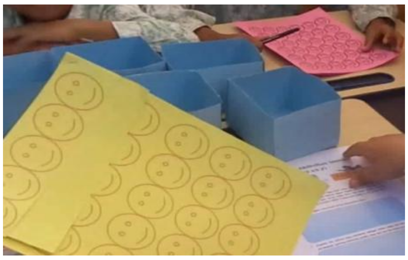

Figure 4.7. Boxes and colored paper

Because classes are available, amounting to 5 class , the boxes provided also 5 box . At first this rare 5 boxes and prepare students to name each box as shown below

Figure 4.8. Students to name each box

Furthermore, students will cut the paper in accordance with the number of new students who have signed up both boys and girls . However, in determining the number of male students and students who have signed up students experiencing problems, they forget how many boys and girls who enroll that they remember only the total amount.The following quote is 6 dialogue between researchers and students about the number of male students and female students .

Researcher : "The number of male students yesterday how many ? "
Dzaki : "70 " (confused , seeing his keteman) .
Researcher : " How many ? "

Desti : " 60 " .
Researcher : " 60 how much? Come be remembered that the number of male students there how "
Kevin : " forgetbu "

Excerpts 6. Determining the number of male students

All students forget the number of male students who have signed up so that researchers bring back the discourse on LAS 1.Furthermore, after the student recalculate the number of male students and the number of female students, chapped will cut the paper as much as the number of new students. Because the number of new students who enroll 125 students were male 57 female students and 68 students. One student all mind if you have cut the paper. The following quote is 7 dialogue between researchers and students about cutting the paper.

Kevin : "Mom 's cut all ? " .
Researcher : "Yes according to the number of students "
Zein : " meant that as many as 57 yellow and pink as much as 68 "
Researcher : "Yes "
Kevin : "Oh misstired "
Researcher : " it's okay , forward gentian "
Kevin : "Yes miss "

From the quote above 7 Kevin objected to cut all the paper because he thinks too much. The following pictures when students cut the paper.

Figure 4.8.student activities cutting the paper

Following from paper cutouts of the students are asked to enter the paper one by one into the box. But in this case there is a group who use their own strategy in leveling the number of students in each class. The following excerpt 8 on strategies students

Researcher : "already filled in the box?"
Zein : "yes miss"
Researcher : "how?"
Kevin : "there were 125 students were divided 5 to 25 continue to be divided 25 male students and female students for 2 so 12.5. So that the male students 12 students of her 13"
Researcher : "oh so later the number 25"
Kevin : "Yes miss"

In the excerpt 8 Kevin strategy division but Kevin is not aware there was a problem when determining the number of male students and female students in the classroom.

For groups Naswa, Desti and Dzaki they follow the instructions contained in the LAS is put strips of paper one by one so chapped no trouble. Here's a picture on the calculation of paper in each box.

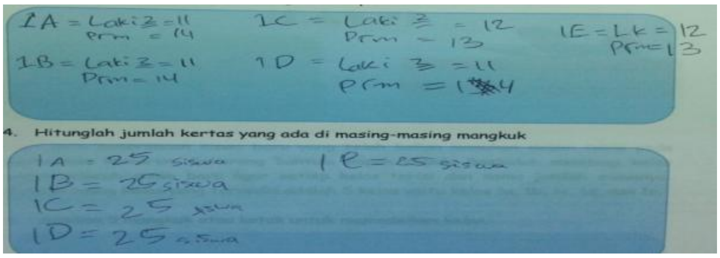

Figure 4.9.the students' answers to the number of students in each class

Kevin back to the group, Zein and Supreme when chapped finished entering all the cutouts and then broke calculating cutouts on each box and chapped find fault. The following excerpt 9 dialogue between researchers and students in leveling the amount of paper in each box.

Researcher : "you have entered all the paper?"
Zein : "yes miss"
Researcher : "Now count of each paper in each box"
Kevin : "1A boys 12 students of her 13"
Zein : "1B students male 12 female students 13"
Agung : "1C male students 12 students of her 13"
Kevin : "1D boys 12 students of her 13"
Researcher : "To 1E how?"
Kevin : "the men there were 9 students and the women there are 16 bu"
Researcher : "nah whether equitable distribution has been what has been the mean number of male students and female students in class?"
Kevin : "not fair how do I, confused miss"
Researcher : "well now think again how to be fair and the average amount in each class, read again the instructions in LAS
Kevin : "oh yes miss enter one by one"

In this excerpt group 9 Kevin experienced in taking the strategy in a paper insert in each box so that the number of male students and female students in each class is not flat, but after discussions and guided Kevin group can solve the problem. Here are the results of the group answer Kevin

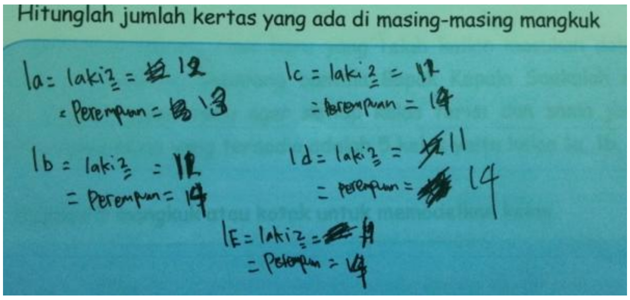

Figure 4.10.the students' answers to the number of students in each class

From 4:10 visible image group answers Kevin how many times changed due to inaccuracy strategies they use.

Retrospective Analysis Activity 3

Based on the activities that have been going on for Activity 3 that define a class for all new students, found some interesting things that need to be discussed. The first students to forget the number of male students and the number of students that both their Another emerging strategy. Most students remember the total number of new students who enroll, but they forget how many boys and how many number of female students. So students must calculate again the amount.

For an emerging strategy there is one group that does not follow the instructions in LAS chapped use their own strategies to put the paper into the box, but the students experienced difficulties in leveling the number of students in each class because there was one box that number of students both boys and female student. Excerpts 9 provides evidence that students have difficulty to flatten the number of students in each class (see line 13 citations 9). Some evidence shows the guidelines that support the activity sheet does not specify the number of students in each class. Thought students in HLT not occur all, where students still experience an error in leveling the number of students in each class. However, because there is one group that is following the instructions on the LAS and their answers are correct then 4 activity can be carried out.

Activity 4 (Determining Formulas Mean)

In Activity 4 students will draw conclusions about the activities that have chapped done. Students will determine the formula for the mean of the activities number of new students who have registered in each class are available. When drawing conclusions, students are guided by the researchers by providing questions that make students think and could find a formula on mean.

Figure 4.11. Researchers help students draw conclusions

The following excerpt shows the 10 debriefing researchers with students about the conclusion.

Researcher : "Now what can you conclude in the conduct earlier if the number of students have already been identified and the amount of class already known?"
Naswa : "before we do the division"
Researcher : "What are you for that?"
Dzaki : "the number of students with a lot of class"
Researcher : "after the split if it is a fair price and the number of students in each class?"
Desti : "Already"
Researcher : "how many of each class?"
Naswa : "25 students"
Researcher : "Yes well that equitable sharing and flat, so that we may conclude that we learned earlier is an average, well now what the formula of the activities of that?"
Dzaki : "the number of students divided by a lot of class."
Researcher : "Yes, that's right, now the general number of students that said amount of data and the number of classes is the number of data. So we can conclude formula is the average amount of data divided by the number of data

10. Excerpts determine mean formula

Excerpt 10 explains the researcher directs students to find a formula on average. Exhume the students' knowledge in the data and remind them about the activities they have done, so that students can find the formula average. In doing inference grouped Naswa having some problems, because they are still shy in expressing opinions.
For groups of Kevin doing conclusion they look bolder in expressing their opinions.

Figure 4.12. Researchers guide students to draw conclusions

Here are excerpts 11 debriefing researchers with students about the conclusion.

Researcher : "Now what can you conclude in the conduct earlier if the number of students have already been identified and the amount of class already known?"
Kevin : "We already know how the number of students, the class how"
Researcher : "yes"
Kevin : "so for us to know the number of students of students of each class that uses an average
Researcher : "the average, how?"
Kevin : "divided by the number of students per class number"
Researcher : "Yes, that's right, now the general number of students that said amount of data and the number of classes is the number of data.So we can conclude formula is the average amount of data divided by the number of data

11. Excerpts determine mean formula

Excerpt 11 explains Kevin group can already reveal that activities did use a chap average. Kevin said the average was dividing the total number of students to the number of classes.

Retrospective Analysis Activity 4

After seeing four events during the activity, it can be seen that the students were able to draw conclusions and to rediscover the average formula is to do activities that fissure dividing the number of new students to the number of classes. In doing inference group Naswa still shy and hesitant in expressing his opinion looks at citations 10 but in groups of Kevin 's suit alleged HLT These groups can be concluded that the fissure made earlier is an average that is dividing the number of new students to the number of classes, look at excerpts 11. Generally all groups were able to draw conclusions in determining the average formula that divides the number of data with lots of data.

RESULTS

Based on preliminary observations during teaching, learning concept on average through the new admissions having some problems and difficulties. In the first activity, students explore the information within the discourse on new admissions. In this activity students are able to determine how many weeks registration opened and determine the number of new students who have signed up every week both boys and girls. In the second activity, students have been able to enter data into the table of frequency distribution capabilities needed here is accuracy in summing and put data within tables.

In the third activity the student is able to define a class for all new students, but still having some problems among students forget the number of male students and the number of female students who have already signed up, they just remember the number of the whole course, so it must recalculate the data of new students who already register, the second at the time of shearing of the paper, because the number of students to cut as many as the number of students who have already registered this takes a long time and make students saturated, the third in LAS instructions no. 3 provided a strategy paper that enter one by one into the box there was a student who broke his own strategy. For the fourth activity of the students were able to draw conclusions in determining the average formula in general.

Based on the findings and records obtained from cycle 1 to improve HLT it will be a bit of improvement. These improvements were made to the use of reason and learning. It can be concluded that the HLT designed using the context of the PSB (new admissions) with PMRI approaches that have been tested and improved to help students understand the basic concepts of the mean.

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Development of Interactive Media Based Learning Subjects Animation Techniques 2 Dimensional Valid in Vocational High School (SMK)

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Abstract

Media used by teachers at a time when the learning process is still not interactive that is shaped like the print module. This research aims to produce interactive media design-based learning, valid for 2 dimensional Animation subjects. This research developed interactive multimedia-based learning media using software Adobe Director. This type of research is research development (Research and Development). This research see if media interactive-based learning designed this valid, then conducted trials experts. The results showed an interactive-based learning media by pundits are already valid. Then it can be inferred that a media-based interactive learning in SMK has been valid.

Keywords: Learning Media, Animation Techniques, Valid

INTRODUCTION

The current development of technologies, the information is presented using the technology. The technology is very instrumental in all aspects of life, including in education. Ineducational technology are instrumental to advancing education, one of which as a developer of learning media in the form of multimedia. More advanced multimedia technology has been the mindset promising a big potential in change, gain information, customize information and more. Multimedia provides opportunities for educators in developing a learning technique, resulting in a product of learning media.

Multimedia is expected to be easier to determine the way how learners can absorb information quickly and efficiently, as well as being able to develop the creativity of learners in the learning process. Learning media has a role as important as educational factors to the other, but sometimes less noticed by the teacher. Whereas in the selection of appropriate learning media, adjusted based on the material to be delivered with the goal to be achieved is one of the keys to success in a learning based on the curriculum that has been set by the Government.

The learning that has been in Government in school as an elementary school, middle school, high school and especially Vocational secondary school (SMK). This is a school that is expected to produce graduates who can work in the corporate world as well as in the industrialized world.

For students of SMK, mastery of this Animation Techniques can support and facilitate the work in the area of his expertise. Good work in the business world and the world of industry or entrepreneurship, basic capabilities in the field of design animation will really help them. Basic Animation Techniques utilization can be studied by all students of SMK competency skills whatsoever. Animation techniques that are studied in General by all students of SMK Multimedia.

In accordance with the regulation of the Minister of national education in 2006 about number 22 Standard contents, subjects of engineering Animation 2 Dimesnsi aims so that learners have the ability to design animation in using computer technology in everyday life as well as the application of computer in accordance with the competency standards of work.

The applied learning with learning methods and media that is used in the form of conventional media in the form of: (1) modules; (2) the Board; (3) motion picture projection showed that the learning process takes place in a conventional and focuses on the process of memorizing on understanding the concept. As a result, the level of understanding of students towards the learning material is low. In addition, learning methods and media like the above do not give ample opportunity for students to learn independently.

Based on the results of the interviews obtained from productive subjects teachers concerned on 17 February 2015 at SMK Negeri 2 Pariaman, found some problems in the process of teaching. Media used by teachers at a time when the learning process is still not interactive i.e. shaped print module so that the lack of motivation of the students in the learning process.

In the process of learning delivery learning material is still one way direction so that the learning process was suboptimal menyebabkankan technique of two-dimensional animation done by the teacher to the students, because the semester 2 teachers should immediately complete all meetings within 3 months of the next three months while the student will carry out the work practices of the industry (Prakerin). This is a demanding teacher to add hours of learning that continued in the afternoon.

The learning process of students having difficulty in the implementation of pratikum in labor, because not yet optimal understanding of the students on the material on the subjects of engineering a 2D Animation looks less active students that leads to weak learning process giving rise to a situation of a class that is less conducive. Whereas the existing facilities at the school are adequate, such as: the existence of labor computer, and LCD projectors. However, inadequate utilization of the facilities in the building an interesting learning media for the sake of lancarnya learning process. Meanwhile, the demands of the criteria which must be reached on the subjects of productive technique of animation 2D is 75. This will be a problem faced by teachers in the learning process. Thus it takes a formula for overcoming the problems faced by the teacher during the learning process.

METHOD

a. Model Development

The type of research that will be done is research and development (Research and development/r & D). R&D is a research method that is used to produce a particular product. Products that will be developed in this research is Interactive Multimedia-based learning Media.

b. Development Procedure

This research will be developed using the Model Research and Dovelopment (R & D) Sugiyono, among others:

1) Potential Problems

According to Sugiyono (2014:298-299), potential is everything when harnessed would be value added, while the problem is the deviation between expected with that happening. And it can be concluded that the problem could be a potential when it can empower in.

The first step in the research is doing interviews to productive subjects teachers majoring in multimedia class XI SMK N 2 Pariaman, and found that the subjects Employed 2D Animation using only the media print module.

Based on the results of interviews and observations already made, the researchers concluded that the problem in this research that is media of learning in the form of "the print module" is still less than optimal in the delivery of material on 2D Animation Techniques subjects, because these subjects will be accompanied also by pratikum. In the process the 2D Animation Techniques learning, the teacher in question also noticed that students have difficulty in understanding the material presented. While the teachers given time only 3 months to 15 x (time) meeting in the complete material Engineering subjects 2D Animation, because after that the students will follow the process of the "Industrial Court Practice" (Prakerin).

2) Data Collection

After potential problems are found then the next needs to be collected in a variety of information or data. According to Sugiyono (2014:300), having the potential problem can be shown and factually and uptudate, then the next needs to be collected in a variety of information that can be used as a basis for the planning of a specific product that is expected to resolve the issue. Here the required research methods. What method will be used for research subject to problems and accuracy objectives are reached.

The data gained during observations in SMK N 2 Pariaman form RPP, Syllabus, and materials Engineering Animation 2 dimensional multimedia vocational class 2 CMS.

Based on information and data from the results of observation and interview subjects to teachers of engineering Animation 2D class XI SMK N 2 Pariaman, found that highly visible media needs will process the achievement of learning objectives. Researchers wear information and results of such data as the basic reference point in the planning process of learning media development. Learning media development based on the steps of its development.

3) Product Design

The resulting products in research and development (Research and Development) is very diverse. In the field of education, the resulting products are expected to increase productivity of education, that is, graduates of which there are many, qualified, and relevant to the needs (Sugiyono, 2014:300-301). This research will produce learning materials in the form of interactive multimedia-based learning media on subjects 2D Animation Techniques.

At this stage the researcher began to design and make product design interactive multimedia-based learning media using software Adobe Director to grade XI SMK N 2 Pariaman on 2D Animation Techniques subjects.

4) Design Validation

Design validation will be done by an expert on experts to assess the medium that has been made in terms of media content, the presentation of media as well as the language used in the media. Product assessment carried out using scoring sheet had already been validated by the lecturer and teacher.

According to Sugiyono (2014:302), product validation can be done by way of presenting some of the expert or experts who have had experience to assess new product that is designed. Each expert was asked to assess the design, so that it can then diketahu weaknesses and shortcomings.

Learning media that is already designed, consulted and discussed with experts the Media and pundits of animation. The advice from experts is used to fine-tune the media. The validation activities are carried out in the form of filling media validation and discussion sheets until it obtained a valid and viable medium to use. As for the aspects that validated can be seen in table 1.

Table 1. Validation Of The Learning Media

No	Aspects	Methods Of Data Collection	Instrument
1.	The material in the Media	Provide validation sheets to Animation and Media experts	Validation fact sheet
2.	Visual Communication		
3	Design Instructional		
4.	The Utilization Of Software		

As for design Validation will be done by an expert on experts to assess the medium that has been made in terms of media content, the presentation of media as well as the language used in the media.

Table 2. List The Name Of The Validator

No	Name	Description
1	Dr. HendraHidayat, M.Pd	Dosen PTIK
2	KarmilaSuryani, M.Kom	Dosen PTIK
3	Hayati, M.Kom	Guru SMK N 2 Pariaman

1. INSTRUMENTS OF THE RESEARCH

Research instrument is the validation of learning Media Development fact sheet. Sheets of this instrument contains aspects of the assessment of the material, Visual communication, instructional design and Software Engineering Subjects in animation. Validation material media study will look at the suitability of the content of the media module with material that it conveys.

Analysis of the contents and validity of invalid constructs using Likert scale based on sheet validation, with these steps:

a. Scoring for each of the likert scale is used
b. add up the score of each indicator for all validators
c. According to Trianto (2007) the granting of the value validity is given by the formula:

$$\text{Nilaivaliditas}= \frac{\textit{skor yang diperoleh}}{\textit{skor maksimun}}\ \boldsymbol{x}\ \mathbf{100}\ \%$$

According of Arikunto (2008), to account the validity of media, criteria used are in the following table :

Table 2. Categories level the validity of Learning Media

No	The Level Of Achievement	Category
1	90-100	Very valid
2	80-89	Valid
3	65-79	Quite valid
4	55-64	Less valid
5	0-54	Invalid

2. RESULTS AND DISCUSSION

The research of Multimedia-based learning Media Development Interkatif Software with Adobe Director

According to Sugiyono (2006:298) research process starting from the steps as follows: (1) the potential and problems, (2) Pengeumpulan, (3) data product design. Design Validation (4), (5) revision of design, (6) testing products, Product Revision (7), (8) trial usage, product Revision (9), (10) Mass Production, steps in the development of this research is limited to step 7.

a) Potential and problems

The problem often encountered by teachers at a time when the learning process is still lack of media that will be used by the teacher at the time of delivery of the materials and time limitations which belonged to teachers in completing the material in Engineering subjects 2 dimensional Animations i.e 3 months for 15 times. In this case the researchers see teachers still use media in the form of printed books, so students are less motivated and enthusiastic at the moment following the learning process.

b) Data collection

Media design-based learning using interactive multimedia software Adobe Director, while material is designed based on the potential and problems. Data collection started from direct observation at the time of the student's learning process, an analysis of the material, and characteristics of the students. The following are descriptions of the results of the data collection, namely:

1) Observations

Learning media used in subjects 2 dimensional Animation students of SMK N 2 Pariaman are still limited Multimedia Majors who just use the print book at the time of the submission of material by teachers is concerned, this has resulted in students haven't been able to fully understand the subject matter 2 dimensional Animation.

In addition, teachers are given only three months to 15 times in completing all the material on the subjects of engineering Animation 2D, because half of the semester (3 months) the next student will carry out field work Practice (STREET VENDORS). This is a demanding teacher to add hours of learning that continued in the afternoon. Thus, students have difficulty in the implementation of the dilabor, because pratikum has not been optimal understanding of the students on the material on the subjects of animation 2 dimensions.

2) Analysis of the material

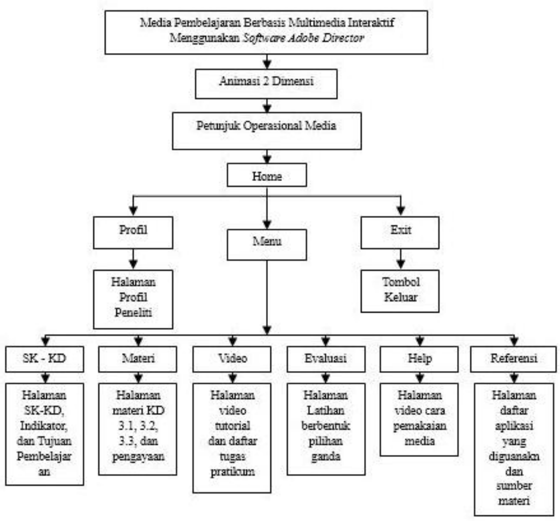
The material to be developed in a media-based learning using interactive multimedia software Adobe Director is concerned on 2 dimensional Animation subjects of Class XI semeseter 2. The basic competence to be achieved are composed on KD: 3.1 "Understand Techniques AnimaiTweening", KD: 3.2 "understanding object creation Technique in the application of 2-dimensional", KD: 3.3 "understand how to Give Audio effects on a 2 dimensional Animations".

3) Characteristics Students

Characteristics of students in the analysis include the background of the students, the ability of the students both in Audio, Visual, and Audio and Visual experience that aims to help researchers in developing learning bebrbasis media interactive multimedia software using Adobe Director of animated material used in 2 dimensions. Characterisitics of this sangatalah it is important to pay attention to the abilities, traits, and the experience of the students either by individuals or groups.

c) ProductDesign

The design of the product design interactive multimedia-based learning media using software Adobe Director to grade XI SMK N 2 Pariaman on 2D Animation Techniques subjects.



Using Interactive Multimedia Software Adobe

media-based learning using interactive multimedia
ple lecturer Education Engineering Informatics and

computers and 1 teachers SMK N 2 Pariaman Vocational Multimedia uses the now Test validity. It can be concluded that the media-based learning using interactive multimedia software Adobe Director with very Valid criteria, this media may be used as a medium of instruction, with a little revision.

Figure 1. Main Page

Figure 2. Main Menu

2) Analysis of the validity of the Media-based learning Using Interactive Multimedia software Adobe Director.

The results of the analysis of question form validation that has been rated by valiaor against the media-based learning using interactive multimedia software Adobe Director, is known to be done improvements against the media developed it. The first validation test by the Validator (1) Hendra Hidayat, m. Pd through 2 times improvement with value 58.57% criteria "less Valid", and 80% of the criteria of "Valid", Validator (2) Syriac Karmila, m. Kom through 1 time improvements with a value of 70% of the criteria "less Valid", Validator (3) biodiversity, m. Kom through 1 time improvements with the value 74.28% criteria "less Valid". After improved based on suggestions by the validator, the value obtained on the final validation test was: Validator (1) Hendra Hidayat, m. Pd with a value of 95.71% criteria "very Valid", Validator (2) Syriac Karmila, m. Kom with a value of 95.71% criteria "very Valid", Validator (3) biodiversity, m. Kom with a value of 97.14% criteria "very Valid". From the analysis of the final validation test conducted by the validator, it can be concluded that the media of instruction are in very valid criteria.

CONCLUSION

a) Generated Media-based learning using interactive multimedia software Adobe Director for subjects 2 dimensional Animations Vocational secondary school (SMK) which has been rated by the validator are stated in the criteria "very Valid". With these criteria, then this learning media products can be used as a device of learning by teachers and students.
b) Generated Media-based learning using interactive multimedia software Adobe Director for subjects 2 dimensional Animations Vocational secondary school (SMK) stated very practical for students with a value of 92.38% criteria "very practical". This assessment is based on a variable interest students, the learning process, the student's activities, time available, and evaluation.

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THE DEVELOPMENT OF MATHEMATICS LEARNING INSTRUMENTS BASED ON GUIDED DISCOVERY FOR GRADE VIII STUDENTS AT ISLAMIC JUNIOR HIGH SCHOOL IN PANYABUNGAN

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Abstract

The goal of this research is to produce learning tools based on guided discovery that valid, practice and effective.Inthis research, aguided discovery-based learning toolsthat includelesson plansandworksheets.Thedevelopmentof researchusing4Ddevelopment modelthat consistsoffourstages, namelydefine, design, develope, anddessiminate. Subyektrialwas eighth grade in Islamic Junior High School Panyabungan. Validation was doneby experts inmathematics education, educational technology, andlanguage education. Practicalitylearning deviceseen fromone-on-one interviews, observationof smallgroups, fillinga questionnairebystudents and teacher on thepracticalities oflarge groups, while theviewseffectiveness ofstudent learning activitiesandteststudents' mathematicalcommunication skills. Learning devicehas been declaredinvalidin termsof constructand contentby experts. The results ofobservations, questionnairesandinterviewsstatingpracticallearning toolsalready, andhaveeffectivelyseen fromthe student activity andteststudents'communication skillsincreased. Based on these results, we can conclude thatguided discovery-based learning toolsformath learningfor eighth grade in Islamic Junior High School produced arevalid, practical, andeffective. Then, the tools wasdessiminated to 1 different class in same school.

Keywords: learning device, guided discovery, development model4D.

INTRODUCTION

Addressing the importance of mathematics, making these subjects are always taught in any educational institution and at each grade level with a portion of lesson hours is far more than other subjects (Appendix Permendikbud No. 58 of 2014). It shows that education experts and curriculum designers realized that the mathematics courses to meet the expectations in the provision of human resource potential that is reliable, namely human resources that have the ability to reason logically, critically, systematic, rational and careful; has the ability to be honest, objective, creative and open; have the ability to act effectively and efficiently; and have the ability to work together, so it has the ability to answer the challenges of globalization and the rapid development of science and technology today and the future

Based on the results of observations made in class VIII MTs namely MTsNPanyabungan and Madrasah IslamiahMardiahPanyabungan, phenomena that appear are still many students who look less able to communicate ideas or ideas to other students or the teacher. From interviews with teachers of mathematics, found that mathematical communication skills of students is still low. It can be seen from 1) students when given the opportunity to ask the students do not ask questions; 2) students are more likely to memorize formulas of the understanding; 3) students are not able to perform communication between the students while working on group assignments, students tend to work on their own and then other friends who follow it; 4) students are not accustomed to the problems of mathematical communication, so when given the problems are not in accordance with examples of questions that students will feel confused to find a solution.

Of the above problems, the need for the development of learning tools that can help facilitate teachers to design a device that can engage students, especially in learning so that students can easily understand the concept of learning and honing communication mathematic skills . One method that can be used is the method of guided discovery. Suryosubroto (2009: 178) states that the method of discovery (discovery) is defined as a procedure to teach the importance of teaching, individual, object manipulation and other experiments, prior to the generalization. Before the students aware of the understanding, the teacher did not explain in words. The use of discovery methods in the learning process, allowing their students find their own information traditionally ordinary notified only.

The learning method guided discovery is an alternative teaching methods selected in the process of learning, considering the learning process required some form of activity that can alter the student to be able to find a concept through creativity directly so that the learning method guided discovery is expected to occur active communications directly between teachers and students, and also in communicate mathematical symbols. Thus, students can progress towards the expected. Therefore, it was necessary to improve the abilities to use skills include formulating the problem, suspect the answer, designing investigations, experiments, process the data, evaluate results, and communicate findings to others in many ways.

Based on the results of research conducted by the Kubicek (Berta Sefalianti, 2014: 14) that guided discovery-based learning can enhance students' understanding by involving students in the process of active learning activities, so the concept is achieved the better. Guided discovery learning method allows students to engage actively using physical processes in finding themselves some of the concepts and principles of the material being studied under the guidance of teachers so that the subject matter is not only a material but also builds morale of students.

Formulation of the problem in this research is how the process and outcomes-based mathematics software development guided discovery are valid, practical and effective for students of class VIII MTs in Panyabungan?

Based on the formulation of the problem that has been presented, the objectives to be achieved in this research is to produce devices based on guided discovery learning mathematics are valid, practical and effective for students of class VIII MTs in Panyabungan.

METHODS

The development model used in this research is the development model 4-D (Four-D). Model development of the 4-D (Four-D) is a model of the development of learning tools developed by S. Thagarajan, Dorothy S. Semmel, and Melvyn I. Semmel. This development model consists of four steps: Define, Design, Develop and Disseminate, or adapted into model 4-P, namely Pendefenisian, Design, Development, and Deployment. This development is performed only at the development stage.
The advantages of the model 4-D, among others: (a) more appropriate to use as the basis for developing a learning device is not to develop a learning system, (b) the description seems more complete and systematic, (c) in its development involves the assessment of experts, so that before the test try learning devices in the field has been revised based on assessment, advice and input of experts. Validation of the device by three professors of Mathematics, one lecturer Indonesian, and one lecturer in Education Technology.

RESULTS AND DISCUSSION

At this stage of define do a needs analysis, curriculum analysis, concept analysis, analysis of literature books, and analysis of student character. At this stage of needs analysis was conducted to see picture of conditions in the field relating to the study of mathematics in class VIII MTs.At this stage, the analysis of the needs of students, namely in MTsNPanyabungan and MMI Panyabungan.After observation and interviews encountered several obstacles faced by teachers and students in mathematics. Students are only able to memorize math concepts without understanding the concept. Students are also less accustomed to express and communicate his ideas. This happens because the learning process is still not involve students actively to find a mathematical concepts and communicate ideas. In the learning process, students are not encouraged to understand the process of the invention but directly given formula. Then, the teacher did not create their own teaching materials, so that the necessary requirements have not been met students in total. Based on these findings, students need learning tools that can guide him to find a concept that students are more accustomed to communicating mathematical ideas. For product specifications, the students interviewed about the design worksheets that are needed. Based on the results of interviews showed that students wanted LKS attractive, color full color but not too light, and an image related to learning materials.

Analysis carried out on the analysis of the curriculum standards of competence (SK) and basic competence (KD) for the second semester eighth grade material. Curriculum analysis conducted analysis on the material loop, as listed in the content standards (SI). No change in SK and KD that has been set, but there is a change in the composition of the formulation of indicators. The results of the analysis of SK and KD is used to formulate indicators of learning achievement.

Analysis of the concept aims to determine the materials needed in the development of learning tools for achieving the indicators of achievement of competencies. To achieve the indicators 4.1.1 and 4.1.2 required material about the elements and parts of the circle that includes the center of the circle, radius, diameter, arc, talibusur, segment, segment and apothem. To achieve indicators 4.2.1, 4.2.2, and 4.2.3 required material about the circumference and area of a circle. Meanwhile, to achieve the indicators 4.3.1, 4.3.2, 4.2.3, and 4.2.4 requires material about relationships and the central angle around the corner facing the same arc, the nature around the corner facing the diameter and the same arc, arc length, and wide arc

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The next analysis is the analysis of literature books. The purpose of this analysis is to look at the contents of the book, manner of presentation, and practice questions. The results of the analysis of textbooks is the content of textbooks in accordance with the curriculum but the books do not provide learning activities that lead students to be more active in communicating his ideas. Based on the results of the study seem that these books to direct more students to memorize formulas that exist sehiongga students tend to forget the concepts that have been studied. Nevertheless, these books are also very useful as an additional reference for students.

Analyses were also performed on one worksheet. The results of the analysis are LKS only provides a summary of the material contained in textbooks so that students are also not geared to understand math concepts.

Next is the planning stage. After learning indicators formulated, as well as the main concepts set out the next step is to design learning tools such as lesson plans and worksheets based on guided discovery. RPP is designed to guide for teachers in delivering learning materials.

RPP components designed by Permendiknas 41 of 2007 on the standard process for primary and secondary education units. The learning activities are presented in RPP refers to guided discovery-based learning that is integrated in the LKS-based guided discovery. Presentation of RPP identity, competence standard, basic competence, indicators, learning objectives, teaching materials, allocation of time, learning resources and assessment similar to the RPP in general

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Presentation of the material begins to illustrate the subject matter of the study and application problems. Students are required to solve the problems given based on his knowledge and questions that must be answered by the students so that students can understand the concept of the material being studied. To further attract the attention of students, the problem is also given an appropriate image that is expected to help students to understand the given problem

LKS contain questions that lead students to use mathematical communication skills. Students can answer in the space provided. In answering questions, students were directed to discuss with a group of friends so that students can equate the idea in answering the questions. It can make students actively involved in solving the problem.
In the next section, students are given exercises to see the level of students' understanding of the concepts they are learning. By doing the exercises, students are expected to acquire the learning experience and understand the material being studied.

The next stage is the stage of development. At this stage, expert validation, evaluation of individual, small group evaluation, and evaluation of Bexar group to see validftas, practicality, and the effectiveness of the learning. In the RPP validation results showed that to the value of the general validity of the RPP is 3.02 with a valid category. In the validation results LKS seen that the average validity of LKS is 3.35 with a valid category. After revision of the device followed by one-to-one evaluation. LKS tested on 4 votes MTsNPanyabungan eighth grade students. students are selected to attend a one-to-one evaluation stems from the ability of high, medium and low. The test is done with a different time each student. One-to-one evaluation carried out of 5 pieces worksheets for each student. After evaluation conducted interviews to students. The results of the interview used as a material revision to the next evaluation.

After the revision, the worksheet tested on a small group evaluation is 6 MTsNPanyabungan eighth grade students were divided into three groups. Evaluation of small group meetings performed 5 times. Teachers who are implementing a learning tool during the evaluation of a small group is the researchers themselves. After completion of the evaluation of the small group, conducted interviews to students as an input and revisions for the next evaluation tapa.

Evaluation of individual and small group evaluasio done to look at the practicalities of learning tools are developed.Next is the evaluation of a large group. At this stage, conducted a field test at class VIII MTsNPanyabungan to look at the practicalities and effectiveness of the device is guided discovery-based learning. Tests performed 5 times the meeting.

Based on the observations that have been performed 5 times the meeting, it appears that in general learning to use practical worksheets implemented, the time used for each step of effective learning, students are easy to use and do the work at LKS, and teachers can guide students in learning.

Based on the results of teachers' questionnaire responses seen that the average results of the practicalities of LKS is on practical criteria while the results of student questionnaire responses seen that the average test results on the practicalities of the LKS are quite practical criteria to very practical. It can be concluded that the teachers and the students looked at LKS based terbimbingpraktis invention for use in teaching mathematics class VIII.

Further testing of student learning outcomes. Study results obtained in this study came from a test given in the form of mathematical communication test. This test is done to assess the cognitive abilities of students after learning by using guided discovery-based worksheets. Based on the results of the test data showed that out of every indicator of students has increased after a guided discovery-based learning, which makes situasio mathematics and provide ideas in written form 52.78% and 55.56%; the ability to connect real objects and images into mathematical ideas 58.33%; the ability to explain mathematical ideas in the form of tables, figures, graphs, tables, and algebra 22.22%. Effectiveness was also seen from the student activity. From every pertermuan seen that the activity of students is increasing. Activity is seen adal aspects of oral activities, writing activities, and mental acitivities.

Once the device have been make valid criteria, practical, and effective, then the device is deployed. Deployment is limited to one class only. Spread The results indicate that the device was effective.

CONCLUSIONS AND RECOMMENDATIONS

This research is a development that produces devices based learning problem-solving approach in the form of lesson plans and worksheets. Based on the research that has been carried out, it could be concluded the process of software development based learning guided discovery to students of class VIII MTs in the material fractions in the form of RPP and LKS carried out with the development model of the 4-D which consists of four phases define planning, development, and deployment.
Based on the process of development that has been carried out, the results obtained in the form of guided discovery-based learning tools are valid both in terms of content and construct. Device guided discovery-based learning of mathematics developed meets the criteria of both aspects of practical enforceability, ease and time required. It can be seen from the empirical data, ie data practicalities questionnaire by students, teachers and the questionnaire response data is the observation of the implementation of learning. Mathematics learning tool developed based on guided discovery has been effective, judging from empirical data. In this case, the percentage of completeness of students who use the devices based learning guided discovery is 75%.
Based on the conclusions above, the device that was developed based learning is recommended to be used by teachers of mathematics as an alternative learning tool in learning

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The Development of Critical and Creative Thinking Instrument for Decimal Topic at the Fifth Grade of Primary School Students

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Abstract

Learning math has been more emphasis on rote learning and find one right answer to the questions are given, while the high-level capabilities such as critical thinking and creative thinking very rarely trained for students. Instruments to measure critical thinking skills and creative thinking in decimal material is still less developed, so needs to be developed questions to practice critical thinking skills and creative thinking of elementary school students in decimal topic. Critical thinking skills related to the ability to identify, analyze and solve problems with the result in the considerations to obtain the right decision, while creative thinking ability is the ability to elicited a various solutions, the ability to express diverse ideas on the question or statement and ability to come up with an unique ideas in solving a given problem. This research aims to develop instruments to measure critical thinking skills and creative thinking in the fifth grade of primary school students at decimal that fulfill the validity criteria. This research is descriptive. The process of validity arehelded by experts and content validity. Based on the research results obtained by the instrument to measure critical thinking skills and creative thinking are valid criteria.

Keyword: instrument, critical and creative thinking, decimal topic

INTRODUCTION

Mathematics in education is one of the most important subjects. From the lowest level of formal education up to the highest absolute math lessons to be learned. The subjects of mathematics should be offered to all students from primary schools to equip students with the ability to think logically, analytically, critically and creatively.

The description appears in mathematics learning in primary school during this is the emphasis on rote learning and find one right answer to the questions are given, while the high-level capabilities such as critical thinking and creative thinking very rarely trained for students. So the critical and creative thinking ability less geared up because the students are not being helped by the problems that makes the students to think critically and creatively to solve them. Based on the facts on the ground, the problems given to students mostly only includes tasks that must find a correct answer, while the problem that demands students to critical thinking and creative thinking are very rarely given by the teacher to the students.

Isotani, S., McLaren, B.M.,& Altman, M. (2010), in the mathematics domain of decimal, student have common and persistent misconceptions. These misconception have been identified, studied and published by many researchers spanning over 80 years of time. For example, researchers have empirically shown thatsome students believe that shorter decimals are larger because of a confusion withprior learning of fractions (e.g. 0.2 > 0.25 because $\frac{1}{2} > \frac{1}{25}$. Other students believethat longer decimals are larger (0.25 > 0.7) because they confuse decimals with priorlearning of whole numbers (e.g., 0.25 > 0.7 because 25 > 7).

Furthermore there are many misconceptions about the magnitude of a decimal. Many children often use some implicit rules and misinterpret decimals, such students will determine that 12.17 is greater than 12.4 because they reasoned that 17 is greater than 4 (Desmet et al, 2010).

In a study, the instruments is an important element, since the instrument is used as a tool for collecting data. A good instrument and will actually produce results good and true conclusions of a research. Instruments to measure critical thinking skills and creative thinking in decimal material is still less developed, so needs to be developed instruments to measure the critical thinking and creative thinking skills of elementary school students in decimal topic.

This paper presents the results of development of an instrument to measure the ability of critical thinking and creative thinking in the fifth grade of primary school students at decimal that fulfill the validity criteria.

Critical thinking

According to Ennis (1993), critical thinking is a reflective thinking that it makes sense that is focused on deciding what is believed or do. Then Yaumi (2012) States of critical thinking is a cognitive ability to say something with conviction because it rests on a logical reason and evidence.

As one of the ability of thinking that should be developed in the learning of mathematics, National Council of Teacher Mathematic (NCTM) (1998) suggested that included critical thinking in mathematics is the ability to think, covering the elements tested, questioned the relationship, evaluating all aspects of the situation or a math problem.

Critical thinking skills related to the ability to identify, analyze and solve problems with the result in the considerations to obtain the right decision. Indicators of critical thinking skills by Ennis (1991) there are six elements of critical thinking skills that must be developed in learning, especially learning of math. The sixth element by Ennis abbreviated as FRISCO consisting of:

a. Focus on the subject matter
b. The reason given logical and in accordance with the focus of the problem
c. Inference: able to make conclusions with the right reasons.
d. Situation: match with the actual situation

e. Clarity: the existence of clarity regarding the term used so that no one in reaching conclusions
f. Overview: check the back of the already decided

Based on the description above, the indicator of critical thinking skills used in this study are a) students ' ability to analyze the truth or falsity of a statement, b) able to resolve the issue with the actual situation (reasoning), c) able to assess thoroughly the given problem, d) able to give a good reason in resolving a problem, e) able to make conclusions based on the settlement obtained.

Creative thinking

According to Siswono (2006) creativity is a product of one's creative thinking. Creative thinking is a process that is used when we bring / bring up a new idea. It combines previous ideas that have not been done. This will be useful in finding the solution.

To determine a person's ability to think creatively demonstrated through product ideas or creativity to produce something new. According Munandar (1999: 50) creative thinking is the ability to reflect the fluency, flexibility and originality in thinking. as well as the ability to elaborate on (develop, enrich, and detail) of an idea. Furthermore, according to Hamalik (2008:179) "special aspects of creative thinking is a thought diverging (diverging think), which have the characteristics of flexibility, originality, and fluency.

In this study that will be used as a benchmark for creative thinking ability of students are a) fluency; the ability to trigger many ideas, answers, problem solving or questions b) flexibility; ability to express diverse ideas on the question or statement prepared. c) originality; ability to bring unique ideas to solve the problems.

RESEARCH METHOD

This research is descriptive. The instruments developed in this research in the form of questions to measure the critical thinking and creative thinking skill. The instrument was developed by six problems are three questions for critical thinking skills and three for the creative thinking in the fifth grade of primary school students at decimal topic. Every question that was developed based on indicators and indicators about the critical and creative thinking.

The first thing to do in developing this instrument is to design grating, writing about the indicators and questions that are based on indicators of critical thinking and creative thinking skills. Because the validity of an instrument relating to for what the instrument was made, in this study there is some validity were used that content validity, constructs validity and the language that aims to determine the feasibility of the instrument from the aspect of conformity with the theoretical foundation, compliance with format from the point of measurement science and accuracy of language used, from the standpoint of the standard language and the subject that gives a response.

Content validity with respect to the validity of the instrument with the materials that will be asked, according to both per item and according to the questions. Validity is determined by experienced experts. Questions have been developed subsequently validated by experts that are three mathematics education lecturers and one mathematics teacher. This validation is focused on the objectives to be achieved in accordance with the material or the content of the lesson, the fit between the questions with indicators and indicators about critical thinking and creative thinking.

Then construct validity is the degree of an instrument to measure the construct suspected, that behavior can not be observed as we thought there (Ruseffendi, 2005: 154). The instruments developed in this study is an instrument to measure critical thinking skills and creative thinking of students that can not be measured through observation, then there must be a special instrument to measure the students' thinking skills.

The next is test the readability of the instruments that have been developed that is conducted in the fifth grade of primary school students were not used as research subjects. Interest readability test is to determine the extent to which the instrument is made to be understood by students.

Based on the feedback and suggestions of experts that has examined the content, construct and the language of the instrument that has been made and based on the results of the readability test showed that there are still some of the students' difficulties in understanding the statements contained in the instrument so that necessary to do some revisions.

RESULTS AND DISCUSSION

There are the results of the development of the instrument before and after revised based on suggestions from the experts and test results readability by students.

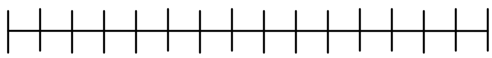
Critical thinking problem

No	Indicators of critical thinking	Before revision	After revision
1.	a. Analyzing of truth / fault for statement b. Answering by the reasons (clarification)	To create a miniature truck of ice cream, you need tires with a diameter of between 1.465 cm and 1.472 cm. If you will be using tires with a diameter of 1.4691 cm, if the tire is suitable for miniature ice cream truck? Explain your answer	Kiki wants to buy milk at the supermarket. There are three types of milk with the same content. Milk A containing 12.34 grams of sugar, milk B containing 12.8 grams of sugar and milk C containing 12.71 grams of sugar. Which do you think most milk contains a lot of sugar?

			Explain your reasons. And Then sort the decimal numbers from the smallest to the largest.

Based on the results and test the above problems that is needs to be revised to change the context of problem to a context that is more easily understood by students and according to the students' everyday life. Then decimals are used on a matter that is before the revision is too large, while decimals taught in the fifth grade that is a decimal number with two decimal places.

<table>
<tr><th>No</th><th>Indicators of critical thinking</th><th>Before revision</th><th>After revision</th></tr>
<tr><td>2.</td><td>a. Make considerations

b. Answering by the reasons (clarification)</td><td>Jono says, "my height 1.2 meters". Seno said, "No you're 120 centimeters height". Are both the above statement correct? Explain your answer.</td><td>Swimming races held on the school, there are three teams that follow the race.
Here is a record of time taken by each team (in minutes).
<table>
<tr><th>Swimming styles</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>backstroke</td><td>4,10</td><td>4,22</td><td>4,13</td></tr>
<tr><td>butterfly</td><td>4,11</td><td>4,2</td><td>4,33</td></tr>
<tr><td>Freestyle</td><td>4,01</td><td>4,03</td><td>4,02</td></tr>
</table>
a. Describe each time obtained by each team on the following number line

b. Based on the number line above, Which team will win the race the pool? Explain your reasons.</td></tr>
</table>

Based on the indicators of critical thinking to be achieved is to make a judgment in resolving a problem, then the problem is before the revised seen that in problem is not suitable for measuring these indicators because students can solve the problem depends on the knowledge that has been owned by the students associated with the unit length.Santrock (2004: 359) explains that critical thinking is "reflective thinking and productive, and involves the evaluation of evidence". Reflective thinking and productive involvement of the feelings in the form of consideration and election-sorting actively undertaken with caution based on existing knowledge to get a conclusion. Despite the conclusions, critical thinkers will evaluate the evidence to ensure that the results of the mind right. In a reflective and productive thinking there will be no answers or ideas guess, that there are hypotheses or assumptions that later proved by evidence evaluation.

No	Indicators of critical thinking	Before revision	After revision
3.	a. Assessing anything thoroughly b. Answering by the reasons (clarification)	Jamila want to make the bracelets will be sold at craft fairs. Each bracelet requires 1.28 meter of ribbon a. If Jamila want to make 84 bracelets, how many meters of ribbon she should buy? Explain your answer. b. In the fabric store, ribbon sold at Rp. 3200 per meter. Justified if the total cost to be incurred Jamila to buy the ribbon is Rp.350.000? include the underlying reason for your answer.	Valid

Based on the results of the validation by experts, the problem above can be used to measure indicators of critical thinking that is judging anything thoroughly, and based on the language of the questions used also clearly appropriate with the EYD and students can understand clearly that no revisions were conducted in this problem.

Creative thinking problem

No	Indicators of creative thinking	Before revision	After revision
1.	Fluency	Known three different decimal numbers and add up the value of ≤ 5. List at least three decimals, and then sort of little value to the greatest!	Known three different decimal numbers and add up the results of less than 5. List at least three decimals, and then sort of little value to the greatest !.
2.	Flexibility	Mr. Ali drove a school bus twice a day for five days a week. The average distance of each journey Mr. Pak Ali is 8.16 km. create some questions of the above information (at least two questions). Then answer one last question.	Mr. Ali drove a school bus twice a day for five days a week. The average distance of each journey Mr. Ali is 8.16 km. Make a few questions from the information above, at least two different questions and related to mathematics. Then answer one last question.

3.	Originality	Temperatures in Banda Aceh increased day by day. The average temperature is rising $0,25^0C$ per day. Today, Monday August 10, 2015, the temperature reached30^0C. Predict your own way when the temperature reaches 42^0C. (At least two different ways).	valid

Based on the advice of the validity of the problem above are to be used to measure the ability to think creatively, just that there needs to be a bit of revision in order to be more problem clear and easily understood by students.

Based on the research results obtained by the instrument to measure critical thinking skills and creative thinking are valid criteria. In the book "Encyclopedia of Educational Evaluation," Scarvia B. Anderson said that “A test is valid if it measures what it purpose to measure” (Arikunto,2006).

The following instruments to measure the ability to think critically and creatively that has fulfilled valid criteria.

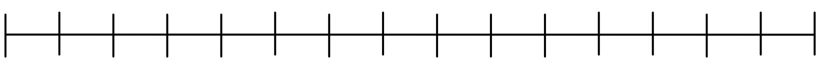
Critical thinking problem

1. Kiki wants to buy milk at the supermarket. There are three types of milk with the same content. Milk A containing 12.34 grams of sugar, milk B containing 12.8 grams of sugar and milk C containing 12.71 grams of sugar. Which do you think most milk contains a lot of sugar? Explain your reasons.
   And Then sort the decimal numbers from the smallest to the largest.

2. Swimming races held on the school, there are three teams that follow the race. Here is a record of time taken by each team (in minutes).

Swimming styles	**A**	**B**	**C**
backstroke	4,10	4,22	4,13
butterfly	4,11	4,2	4,33
Freestyle	4,01	4,03	4,02

a. Describe each time obtained by each team on the following number line



b. Based on the number line above, Which team will win the race the pool? Explain your reasons.

3. Jamila want to make the bracelets will be sold at craft fairs. Each bracelet requires 1.28 meter of ribbon
a. If Jamila want to make 84 bracelets, how many meters of ribbon she should buy? Explain your answer.
b. In the fabric store, ribbon sold at Rp. 3200 per meter. Justified if the total cost to be incurred Jamila to buy the ribbon is Rp.350.000? include the underlying reason for your answer.

Creative thinking problem

1. Known three different decimal numbers and add up the results of less than 5. List at least three decimals, and then sort of little value to the greatest!

2. Mr. Ali drove a school bus twice a day for five days a week. The average distance of each journey Mr. Ali is 8.16 km.Make a few questions from the information above, at least two different questions and related to mathematics. Then answer one last question.

3. Temperatures in Banda Aceh increased day by day. The average temperature is rising $0{,}25^0$C per day. Today, Monday August 10, 2015, the temperature reached 30^0C. Predict your own way when the temperature reaches 42^0C.
(At least two different ways).

CONCLUSION

Based on the feedback and suggestions from the experts and the results of trials conducted and has been revised in accordance with the input of the experts, the instrument developed to measure critical thinking and creative thinking skills in the fifth grade of primary school students at decimal that fulfill the valid criteria.

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DEVELOPMENT MATERIAL WITH SCIENTIFIC APPROACH OF TANGENT TO A CIRCLE

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Abstract

The purposes of this research are (1) to create teaching material of tangent to a circle with specific approach in the form of students' activity sheet which is valid, practical and potential effect as well as explaining its process of development. In developing teaching material, the researcher applies through preliminary and prototyping steps with formative evaluation. There are 39 students of SMPN 9 Palembang involved in prototyping steps. The technique of data collection used is documentation, walk trough, observation sheet, and the test result. This research will result in teaching material of tangent to a circle with scientific approach in the form of students' activity sheet which is valid, practical, and potential effect. The validity of teaching material is viewed from the result of expert validity in the expert review steps and prototype test is in the small group step. On the other hand, practicability of teaching material is gained from the revision result test one-to-one and small group. The potential effect of this teaching material is known from the result of field test and the final evaluation of student test result. The final test result shows score category 48.15% (very good), 33.33% (good), 11.11% (moderate), and 7.41% (poor). From observation done, it is gained the percentage of students activity is above 75% which is categorized 'very good' and 'good'. The analysis result also shows the difficulty of students in learning activity, especially in negotiation activity.

Key words: *scientific approach, tangent to a circle, students' activity sheet, mathematic learning.*

INTRODUCTION

The material tangent to the circle is the development of a material circle, while the circle is one of the subjects of geometry. Circle tangent material taught in junior high school (SMP). Some research on tangent circles, among others, the study of the Soul (2010) analysis of students' mistakes in solving problems of the subject circle tangent conducted on 35 students found that (1) as much as 10.36% of students who made the mistake of understanding the intent matter, (2) as much as 35.36% of students make the mistake of understanding the concept, (3) as much as 25.24% of students make mistakes application of the formula, (4) as much as 16.79% of students make the mistake of counting process, in this study it can be concluded that the fault most is the understanding of the concept of matter tangent to the circle. Research Azimi and Edi (2013) difficulties students study tangent to the circle are (1) understanding the long formula circle tangent if presented in the form definition fomal, (2) distinguish long formula circle tangent fellowship outer two circles with tangents communion within two circle. Judging from the problems of teaching mathematics in schools as proposed by Hasratuddin (2010) that the practice of learning in schools that took place during this time, and hardly at all levels of education, generally lasting one direction, namely the teacher as the center of learning (teacher centered). Nurhayati (2013) teachers are more likely to transfer knowledge to students of mathematics than students construct their own .. Thus, the learning process that occurs is still centered on the teacher, which causes students to be passive while studying.

Based on the above, the need for a strategic approach or model of learning to achieve the goal of education in general and especially of interest in the learning process, one of them with an approach that is used in the curriculum in 2013 that a scientific approach .Adapaun learning process that is applied in the scientific study consisted on five basic learning experiences are: observe, ask, gather information, associate and communicate (Kemendikbud, 2013). According to Kurnik (2008) in his article, the scientific approach to teaching math states that the mathematics teacher did not have to be a scientist who duly and fairly apply the principles of science and the scientific method in teaching. The students gradually and naturally invited to think and how to analyze, synthesis, concluded, inductive, deductive, generalization, specialization, observe analogies in mathematics

From the above, the need for a valid teaching materials and practical developed using scientifc approach. Thus the researchers conducted a study entitled: "Development of Teaching Material material Tangent Circle Scientific Approach". The purpose of this research is to produce a mathematics instructional materials tangent singkaran material with a valid scientific approach and practical and determine the potential effects of the use of mathematics teaching material circle tangent materials have been developed.

RESEARCH METHODS

This study is classified research Reseachdesing models Development Study. Which aims to produce teaching materials with a valid scientific approach, practical, and have a potential effect. Here groove design formative evaluation to be carried out on the research, can be seen in Figure 1.

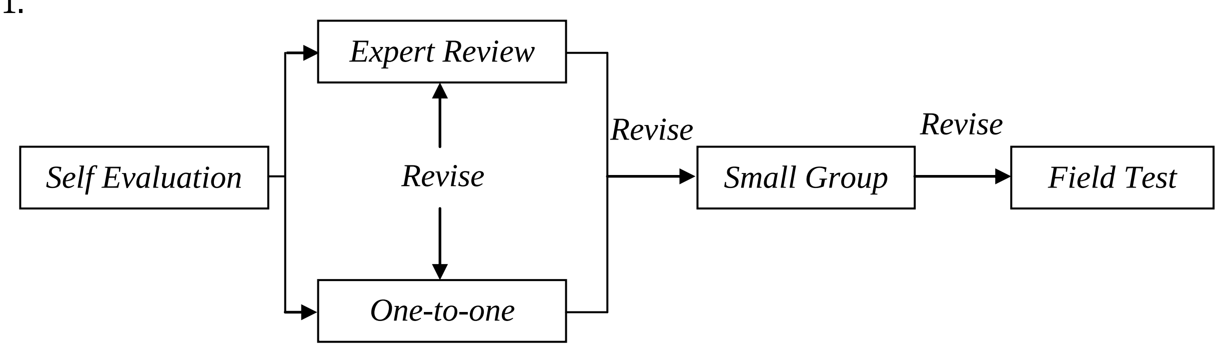

Figure 1. Flow Design Formative Evaluation (Tessmer, 1993)

RESEARCH RESULT

Phase Self Evaluation

At this stage, the researchers re-examined the initial prototype design. In consultation with the supervisor there are some improvements LAS. As examples of changes in the form of images presented in Figure 2.

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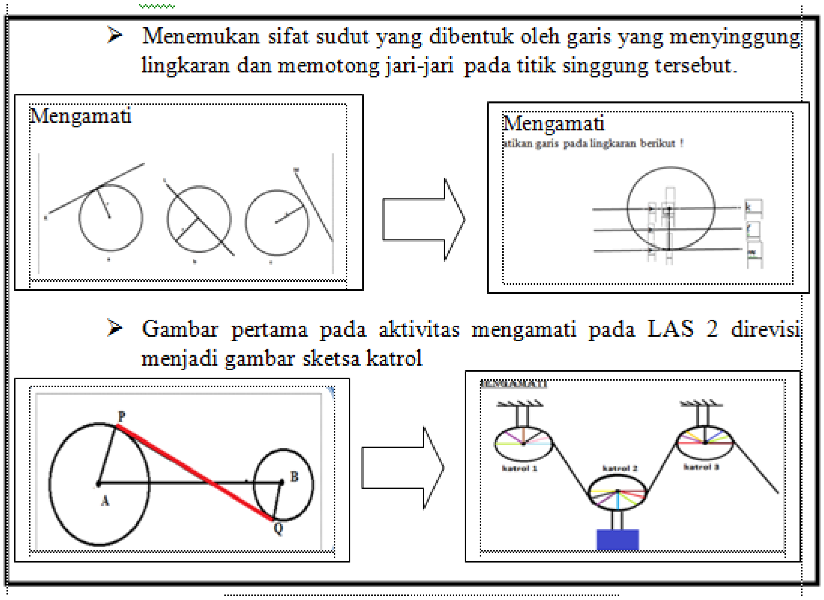
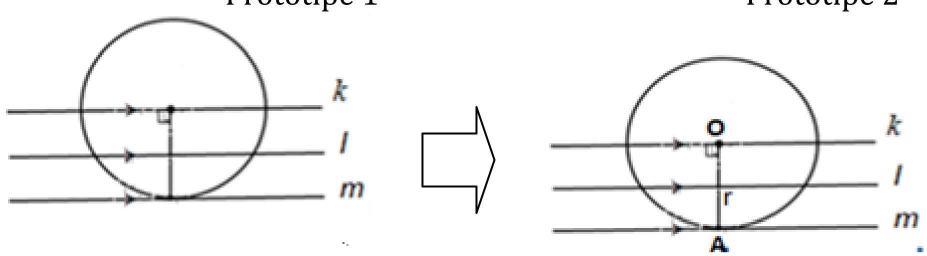


Figure 2. Revised On Self Evaluation

Phase One to one and Expert Review

The first prototype of the self-evaluation results then tested at the stage of one-to-one and expert reviews on simultaneously. Test one-to-one involving three eighth grade students. One example of the prototype revision 1 to 2 prototypes can be seen in the picture

Prototipe 1 Prototipe 2



Prototipe 1:

1. Berapasudut yang terbentukantaragaris k danjari-jarilingkaran?
2. Bagaimanakedudukangaris k dangaris l?
3. Bagaiamanakedudukangaris k dangaris m?
4. Berapasudut yang terbentukantaragaris m danjari-jarilingkaran?

Prototipe 2:

1. Berapabesarsudut yang terbentukantaragaris k danjari-jarilingkaran (OA)?
2. Bagaimanakedudukangaris k dangaris l?
3. Bagaiamanakedudukangaris k dangaris m?
4. Berapabesarsudut yang terbentukantaragaris m danjari-jarilingkaran (OA)?

Figure 3. One Example Changes Being Prototype 1 Prototype 2

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Small Group Stage

Test involves a small group class VIII SMP Negeri 9 Palembang. Respectively of 6 people with academic ability heterogeneous .As forcomments and suggestions as well as the revision of the decision are presented in Table 1.

Tabel 1. Komentar dan Keputusan Revisi Berdasarkan Uji *Small Group*

Unit LAS	Komentar	Keputusan Revisi
LAS 1	➢ Figure there are less understandable (page 9 and page 10)	➢ Clarify description of the fingers perpendicular to the line in question.
LAS 2	➢ language used slightly confusing (page 2)	➢ Reduce the picture of 3 to 2 and clarify the intent of questions.
LAS 3	➢ Figure there are less understandable (picture pulley)	➢ clarify captions picture

Phase Field Tests

The results of the field test are analyzed by scientific aspects of which are described below

(A) Viewing

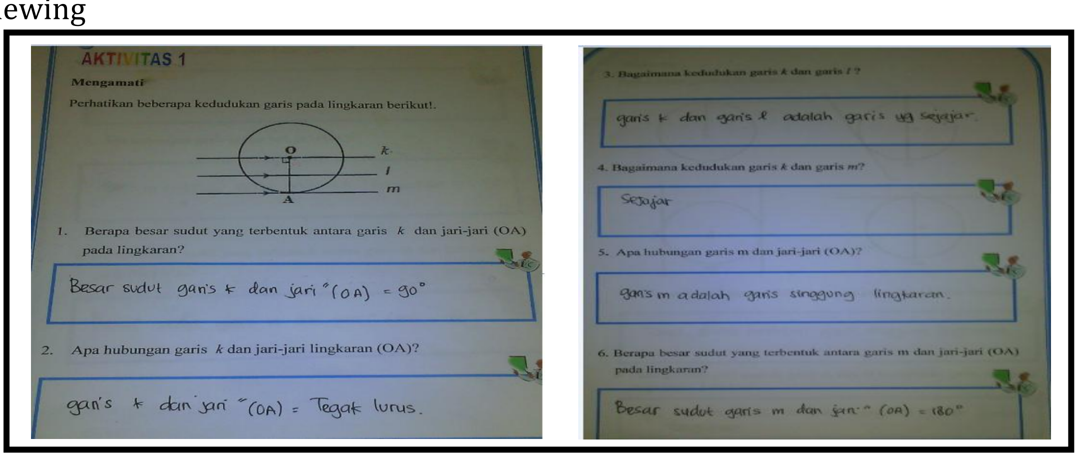

Figure 4. Example Answer Student On Activities Viewing

analysis:

At this stage, students do activities at the picture and understand through questions that given to LAS, the question is given systematically initiated from questions about the angle formed by the line k which is also the diameter and perpendicular to the radius (OA), and the line k, l, and m is a parallel line. so that these questions lead students to discover knowledge of the angle formed by tangents cutting radius at the tangent point. Siswapun, can find a large angle is as shown in the LAS.

(b) Ask

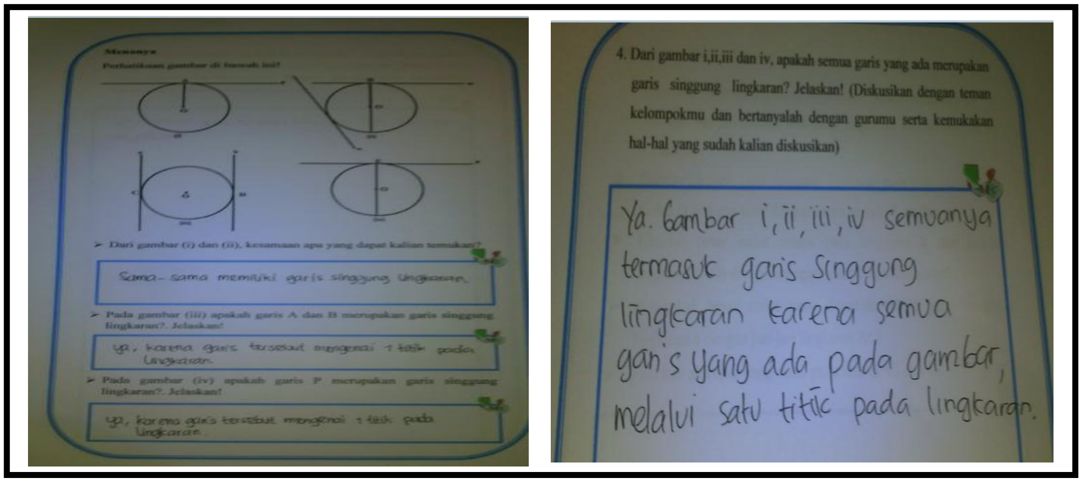

Figure 5. Example Answer Student At ask Activities

analysis:
At this stage the students were given four different images that aims to enable students to compare these images, by comparing these images is expected that students will be asked whether the existing lines is the line singggung circle ?. Here, students discuss and answer the questions in accordance with the knowledge acquired previously, mainly answered by definition of tangents. Furthermore, students also asked about the answers they had to answer, and this is where the role of researchers answer student questions by explaining that the reason given is not only based on the definition but also can be obtained from pengetahuanpada previous stage. From observations made visible that all students perform activities of discussion and asked, as well as the observation stating that the student do ask as expected.
(c) Gathering Information

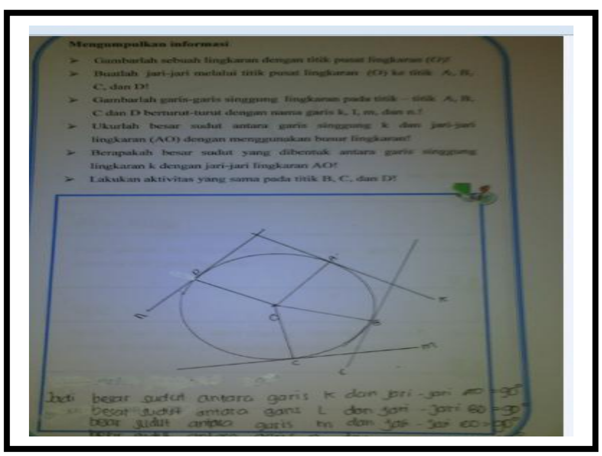

Figure 5. Example Answer Student Gathering Information On Activities

analysis:
All group activities expected according to the researchers. This means that all groups understand the intent of the rule to do the activity. At this stage, students gather information by conducting tried in accordance with the instructions in the LAS.
(d) associate

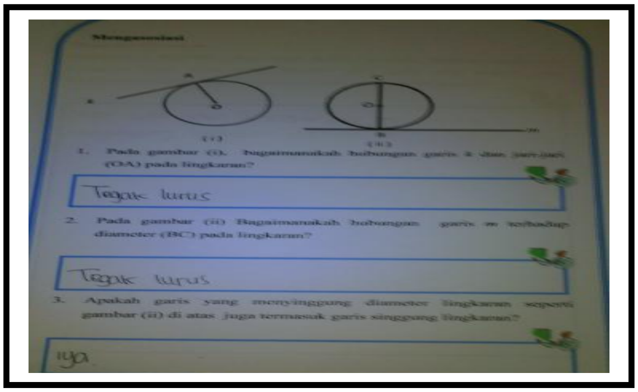

Figure 6. Example Answer Student On Activities associate

analysis:
At this stage, students do activities associate in a way given two pictures, images pertana is a picture taken from previous activities while the second image is a new image that requires students to make sense of the answer and explain the questions. Students answered well, but less able to explain well the intentions rendered image. From observations made visible that all students perform these activities, as well as the observation stating that the student do associate as expected.

(e) communicate

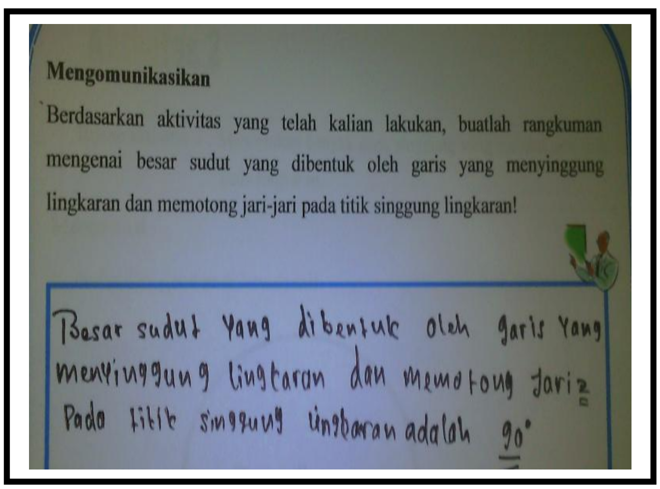

Figure 7. Sample Answers Students On Activities Communicated

analysis:
All of the group makes a summary to answer the purpose of learning. Summary created everything can answer the purpose of learning, the answers vary but maknanyan same. At this stage, the researchers asked the students to explain in their own words to summarize that they create, in a way that researchers can assess whether students have understood the knowledge

that they've got from previous activities. From observations made visible that all students perform these activities, as well as the observation stating that the student do well and correctly. Based on the results of the student and observations conducted by researchers found that students have discovered the nature of the first is that the angle formed between the tangent to the circle and the radius of the circle in the intersection at the point of tangency of the circle is 900.

After that, at the end of the study, carried out tests to measure students' abilities. At this stage the researchers corrected and analyzed data on the student's written assessment of material communion of two circles tangent. Seen from the written assessment test questions students worked. Data results of practice tests students' abilities are analyzed to determine the final value and then converted to the qualitative data to determine the student's ability level categories. The frequency table student's final grades are as follows.

Table. Distribution Frequency Test Results

Nilai Akhir	Frekuensi	Persentase	Kategori Hasil Belajar
85,01 - 100,00	13	48,15%	Very good
75,01 - 85,00	9	33,33%	good
60,01 – 75,00	3	11,11%	Enough
40,00 – 60,00	2	7,41%	less
00,00 – 40,00	0	0	Very less
Jumlah	27	100%	

From the results of the final tests that have been carried out, the test results obtained by percentage above 80% were categorized as excellent and good.

In the process of learning is done also observation of the skill of observing, ask, gather information, associates, and mengomnuikasikan. The dekriptor of each sheet were observed: (1) pay attention to the issues presented in the sheet activities carefully, (2) ask about information that is not yet understood, (3) Conduct activities to obtain information, (4) able to solve the problems given , (5) making the conclusion of the activities are carried out. Data were analyzed to determine students' observation skills attainment Scientific and later converted into qualitative data to determine the student's ability level categories. The frequency table student's final grades are as follows.

Table 3. Frequency Distribution Observations Student Activities

	Pertemuan (%)		
Category	1	2	3
Very good	36,67%	30,00%	26,00%
Good	36,67%	54,00%	63,33%
Enought	20,00%	16,00%	10,00%
Less	6,67%	0	0
Very less	0	0	0

From the observations that have been made, obtained by percentage of student activity above 70% were categorized as excellent and good.

DISCUSSION

After going through a development process that starts from self evaluation, one to one and expert review, and a small group of student activity sheets obtained (LAS) were developed based on scientific approach considered valid and practical. Valid drawn from the results of the assessment validator, where all validators expressed either by the content (sesusi with basic competence and indicator materials tangents alliance of two circles), construct (in accordance with the characteristics / prinsif approach scientific), and languages (in accordance with the EYD, the sentence is not contains a double interpretation, limits the obvious question). Practical drawn from the results of field trials where the average student can use teaching materials in the form of LAS well. Practicality LAS views of the learning process at the time of a small group, where all the students in the group can fill LAS given. LAS have been made starting from observing a particular issue, which assisted with the questions, so that students can discover knowledge pemebelajaran expect on purpose, then the student will go through tahapana ask, gather information, associates, and mengomunikasiakn. All stages are interrelated, which in turn students can conclude as a whole a concept, or a formula that has been found. Easy to use user, sesusai mindset of students, easy to read, do not give rise to diverse interpretations, and can be used by students well. Potential effects can be seen from the activities of the students in doing LAS, where students can easily understand mathematical concepts contained in LAS and use these concepts in solving problems appropriately given. In addition, the potential effects on the response of students after doing LAS.

Discussion of the learning process when students are working on LAS 1, LAS 2, and 3 LAS Observer assessment using observation sheet. Observation sheet that is used to load the five elements, namely menagamati scientific approach, ask, gather information, associates, and communicate. Of the five votes, the associate activity plays an important role in improving students' ability to reason. In LAS 1, students started the activity at the picture, discuss and ask, gather information from the activity of painting pictures and then the students reasoned that eventually students discover the properties of the offensive line circle. In LAS 2, students also initiated activities to observe pictures, discuss and ask, gather information from the activity of painting pictures and then the students reasoned that finally found the formula determining how long tangents outside two lingkarn fellowship. In LAS 3, students also initiated activities to observe pictures, discuss and ask, gather information from the activity of painting pictures and then the students reasoned that finally found the formula determining how long a tangent communion in two circles.

CONCLUSIONS AND SUGGESTIONS

This research has resulted in a product form alliance LAS two circles tangent-based scientific approaches are valid and practical to use grooves Formative Evaluation. Valid can be seen from the results and outcomes assessment validtor one to one. Practical drawn from the test results of a small group. As well as having a potential effect that is visible during the field test. From the analysis of the test results, LAS developed in accordance with the characteristics of the approach scientific, namely (1) the LAS loading stages observe, ask, gather information, associates, and communicate, (2) LAS developed its uniqueness is that it can develop the ability to reason learners, (3) LAS developed easily be done in accordance with the logic of the junior high school level students, easy to read, do not give rise to multiple interpretations, and can be provided and used by all students.

Based on the research results and conclusions, it is suggested to other researchers in order to develop teaching materials tangent to the circle with a scientific approach to students' reasoning ability.

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DEVELOPMENT OF TEST FOR MEASURING INSTRUMENTS SCIENCE PROCESS SKILLS STUDENTS OF PHYSICAL EDUCATION STKIP PGRI LUBUKLINGGAU IN BASIC ELECTRONICS THE LESSON'S

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Abstract

Development of Test for Measuring Instruments Science Process Skills Students of Physics Education III semester STKIP PGRI Lubuklinggauin In Basic Electronics TheLesson's contains aspects of KPS. Matter of Basic Electronics components and electrical circuits. This study was conducted of the month August 2015 s.d. January 2016. The form of this research is the Research and Development (R & D). Stages of development of test instruments are made indicator questions, create questions, judgment by subject matter experts and expert evaluation, revision questions, test, and implement the revised about a matter in small classes. Science process skills assessment instrument is validated by validator consisting of 3 people validator (3 lecturers). In this study the author only discusses the development of science process skills assessment instruments using assessment instruments. Problem test instrument comprising 16 questions that contain aspects of science process skills. Next, the researchers tested the instruments, Based on the results of research conducted, it can be concluded that the assessment instrument science process skills in the subject of basic electronics first developed in this study amounted to 10 grains of instruments that contain aspects of KPS observation, classification, determine the hypothesis, interpretation of data, prediction, planning experiments, communication and implementation otherwise agreed concepts used and accordance with aspects of language.
Key words: science process skills, instruments, basic components of electronics and electrical circuits

INTRODUCTION

The development of science process skills assessment instruments (KPS) is necessary because these instruments are aimed at developing students' skills in process knowledge in physics education, find and develop their own facts, concepts, and values required. Students are given the opportunity to directly engage in the activities and scientific experience as done/experienced by scientists. However students are educated and trained to skilled in obtaining and processing information through the activity of thinking by following the procedure (method) scientific, such skill of observation, measurement, design and assemble the instrument experiments, testing hypotheses through experiments classification, drawing conclusions, and communicating findings verbally and in writing. based on the description above the author wanted to try to present a paper entitled "**Development Of Test For Measuring Instruments Science Process Skills Students Of Physical Education STKIP PGRI LubuklinggauIn Basic Electronics The Lesson's**".

THEORY

the lesson of Basic ElectronicsI, II and basic electronics lab courses I, II totaling 8 credits are mapped in the 3rd semester and 4th semester study program physical education. This lesson is included in the course work skills play an important role in the printing of physical education graduates in order to have a Life Skill in the field of electronics. Subjects of interest is the students are expected to have the ability to explain the electronic systems theory, equations, calculations relating to the manufacture of electronic components, properties/its characteristics, and their application in electronic circuits. Furthermore, students have the ability to analyze and make a simple circuit design with the existing procedures in practice. This lesson is delivered through a process of scientific inquiry, can train and develop science process skills of students. This is the characteristic of learning basic electronics.

a. Science Process Skills

ConnySemiawan in Yaspin (2015: 407) reveals that there are several reasons underlying the need for process skill approach applied in daily learning activities, namely (a). The development of science takes place more rapidly and therefore can not anymore teachers teach facts and concepts to students. (B). Psychologists generally agree that students easily grasp the concepts are complicated and abstract if it is accompanied by concrete examples. (C). Discovery science is not absolute one hundred percent, discovery science is relative. (D) In the process of teaching and learning, concept development can not be separated from the development of attitudes and values in students. Based on the above four reasons need to find ways of teaching and learning as well as possible. The ability of the students in finding concepts need to be equipped with a process-oriented learning activities (student centered). In this case the teacher can develop science process skills in science lessons.

b. Types of Science Process Skill

The Types of Science Process Skills by Harlen in NuryaniRustaman Y., et al (2005: 80-81) as follows:

1. **Observation Skills**

   These skills relate to optimal use and proportional across the senses to describe the objects or measure the characteristics of minute objects observed. To be able to master the skills of observing, students should use as many senses, ie, seeing, hearing, taste, smell, and taste. Thus it can collect the relevant facts and adequate. Observation skills include using the senses of sight, smell, listener, taste and touch in observing the characteristics of an object and using the relevant facts and adequate observations.

2. **Classification Skills**

   Grouping is a systematic used to classify things based on certain conditions. Classify basic skills is the ability to identify the differences and similarities between various objects observed, or it could be referred to as the skills to classify or categorize. Basic needs to be considered in making the classification, such as searching for differences, contrasting characteristics, similarities, comparing, and seek basic grouping.

3. **Interpretation Skills**

   Interpreting the results of observations are interesting tentative conclusions from the data on record. The observed results will be useless if not interpreted. Therefore, observations are recorded and linked, then students trying to find patterns in a series of observations and make conclusions. Interpretation skills include skills recorded observations of a link between observations, and found the pattern regularity of a series of observations to derive conclusions.

4. **PredictionsSkills**

   Prediction is estimated based on the data or trends observed results. If the students can use the patterns observations to propose what might happen in circumstances that have not been observed, then the student has to have the ability of predictive process. Skills predict or forecast includes skill submitted estimates about something that has not happened by a trend or pattern of existing data.

5. **Asking QuestionsSkills**

Skills asking questions is a basic skills students need to have prior to study a further problem. The questions asked may ask for an explanation, about what, why, how, or inquire background hypothesis.

6. **Hypothesis Skills**
The hypothesis is a reasonable estimate for explaining an event or a particular observation. Hypothesize skills are skills in formulating a theory or opinion considered correct, the truth remains to be proven. It should be emphasized that the hypothesis is different from the predictions. The hypothesis is based on understanding a theory or concept of the deductive method, while predictions based on data or data patterns and trends with an inductive method.
7. **Planning an Experiment or Investigation Skills**
Included in the kinds of skills are skills determine which tools and materials, define the variable or variables involved in an experiment, determine the control variable and independent variables, determine what is observed, measured, or written, as well as determine how the work steps and how to process the data.
8. **Using Tools and Materials Skills**
To be able to have the skills to use tools and materials, by itself students must use the tools and materials directly in order to obtain direct experience. In addition, students need to know why and how to use the tools and material.
9. **Apply Concept or PrincipleSkills**
These skills include, among others skills to explain new events using the concepts that have been held, as well as when students apply the concepts they have learned in new situations, or applying the formulas in solving new problems.
10. **Communication Skills**
Inform the observations, the results of prediction or experimental results to others, including communication skills. This form of communication can be in the form of oral and written. This type of communication can be in the form of exposure to systematic (report) or a partial transformation. Communication skills include learning to read charts, tables or diagrams.

RESEARCH METHODS

This study was conducted of the month August 2015 s.d. January 2016. The form of this research is the Research and Development (R & D). Stages of development of test instruments are made indicator questions, create questions, judgment by subject matter experts and expert evaluation, revision questions, test, and implement the revised questions in class about the sample. Science process skills assessment instruments can be used if it has been declared valid by the validator and reliable, it takes the validator as a resource team consisting of three people validator (3 lecturers). Furthermore, the validator provides an assessment of each item contained in the tool according to the criteria in Table 2 and Table 3.

Table 2. Score Rating Validator

Category	Scores
Strongly Agree (SS)	4
Agree (S)	3
Less Agree (KS)	2
Disagree (TS)	1

Source: Sugiyono (2005)

Table 3.Range of Average Score

Kategori	Range of Average Score
Strongly Agree (SS)	3,5 - 4
Agree (S)	3 – 3,4
Less Agree (KS)	2,5 – 2,9
Disagree (TS)	< 2,5

Source: Sugiyono (2005)

RESULTS AND DISCUSSION

The result of the development in the form of test instrument science process skills materials basic electronics components have different stages of R and D as follows: (a) Make a grid about the instrument, at this stage makes grating about the instrument in the form of multiple choice questions with 16 questions as trial instrument with 8 indicators process skills science. Grating about science process skills are presented in Table 4 (attached). (B) Judgement by subject matter experts and expert evaluation, after about arranged next step is to judgment in the validation by the three expert lecturers namely 1 expert lecturers and 2 lecturers matter expert evaluation of learning using the assessment sheet science process skills test. The results of the expert assessment are presented in Table 5. (c) Revision matter, at this stage about the revisions based on the suggestions of the validator (d) Test, test instrument and then analyzed validity, reliabelitas, test distinguishing features and level of difficulty the issue semester 6 who have taken the same course. (E) Revision matter and implement the matter in the sample class.

Table 5. Judgement by Expert Content and Expert Evaluation Indicators suitability KPS

No	Types of Science Process Skill	Instrument Numbers	Rating 3 Lecturer Expert	
			Score avarage	Category
1	Observation	1,2	3,7	SS
2	Classification	3,4	3,8	SS
3	Hipothesis	5,6	3,3	S
4	Interpretation of data	7,8	3,6	SS
5	Prediction	9,10	3,7	SS
6	Planning an experiment	11,12	3,8	SS
7	Communication	13,14	3,6	SS
8	Apply Concept or Principle	15,16	3,7	SS

Table 6. Aspects of Conformity Language

No	Aspek Yang Dinilai	3 expert of assesment	
		The average score	Category
1	Indonesian accordance EYD	3,8	SS
2	Use of Sentence easy to understand	3,5	SS
3	Symbols, Charts, Numbers And Images Can Be Read And Seen Clearly	3	S
Average		3,43	Agree (S)

Table 7. Summary of Analysis Instruments

Test	Validity		Reliability	Power of differentiator		Problem Item Level		Description
1	0,84	Valid	**0,81 High Reliabelity**	0,72	Very Good	0,81	easy	Be Used
2	0,72	Valid		0,70	Good	0,89	easy	Be Used
3	0,00	Not Valid		-	-	-	-	Not Used
4	0,79	Valid		0,81	Very Good	0,61	Moderate	Be Used
5	0,83	Valid		0,6	Good	0,5	Moder	Be Used

				7		3	ate	
6	0.00	Not Valid		-	-	-	-	Not Used
7	0,78	Valid		0,68	Good	0,82	easy	Be Used
8	-1,71	Not Valid		-	-	-	-	Not Used
9	0,71	Valid		0,29	Enough	0,68	Moderate	Be Used
10	-0,23	Not Valid		-	-	-	-	Not Used
11	-0,13	Not Valid		-	-	-	-	Not Used
12	0,54	Valid		0,37	Enough	0,73	Easy	Be Used
13	0,69	Valid		0,61	Good	0,67	Moderate	Be Used
14	0,73	Valid		0,65	Good	0,58	Moderate	Be Used
15	0,80	Valid		0,70	Good	0,60	Moderate	Be Used
16	0,65	Valid		0,09	Ugly	-0,13	Very difficult	Not Used

In this study the author only discusses the development of science process skills assessment instruments using assessment instruments. Problem instrument containing aspects sans process skills used by the author in this study only 10 items were used 16 questions as trial instrument consisting of KPS aspects of observing, classifying, hypothesize, interpret data, predict, plan experiments, communicate and to apply concept.

CONCLUSION

Based on the results of research conducted, it can be concluded that the assessment instrument science process skills in the subject of basic electronics first developed in this study amounted to 10 grains of instruments that contain aspects of KPS observation, classification, determine the hypothesis, interpretation of data, prediction, planning experiments, communication and implementation otherwise agreed concepts used and accordance with aspects of language.

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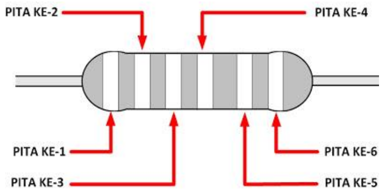
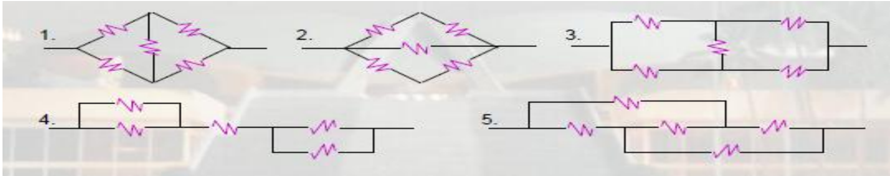
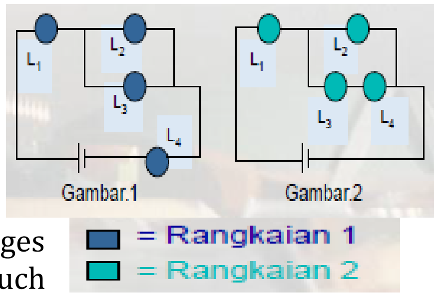
APPENDIX 1 WRITTEN TEST INSTRUMENTS

INSTRUCTIONS

Work on about below carefully and give your reasons for you to choose that answer! Table 8 grating science process skills test instrument

Indicator KPS	indicator test	**No.**
Data Interpretation Skills	***Students are able to interpret data on the respective band resistor***  Note the picture next to it. In Resistor Color Code System 6 tape as shown above. The correct sequence is a. 3 The first tape shows resistance value, the tape showed four decimal multiplication, tape five shows the values of tolerance and sixth tape shows the temperature coefficient b. 3 The first tape shows resistance value, the fourth band indicates the temperature coefficient indicates a fifth tape and ribbon sixth multiplier show tolerance c. 2 The first tape shows resistance value, the third band indicates multiplication, a fourth band indicates the tolerance, the fifth and sixth tape shows the temperature coefficient value. d. 2 The first tape shows resistance value, the third and fourth band indicates the temperature coefficient, a fifth tape shows the multiplier factor and the sixth band show tolerance e. 2 The first tape shows resistance value, the third band indicates a multiplier, the fourth band indicates the temperature coefficient, the tape showed tolerance fifth and sixth tape indicates the type of resistor. **Give your reasons: ....**	1
Observation	***Students observed the arrangement of obstacles***	2

skills	***replacement of equal value5 pieces of the same electrical resistance alternately arranged into five different series of obstacles.*** According to your observations, circuits which have the same obstacles replacement is a picture:  A. 1, 2 and 3 C. 1, 3 and 5 E. 2, 3 and 5 B. 2, 3 and 4 D. 3, 4 and 5 **Give your reasons: ....**	
classification skills	***Students skilled in classifying function of the capacitor*.** Note the statement below. 1. These capacitors have a polarity, with another distinguishing mark is the presence in the body + capacitor. The sign has a meaning that the pins that are below has a positive polarity, surplus is frequency and temperature better 2. These capacitors material wear titanium acid barium as the dielectric. These components are used on high-frequency dirangkaian because there is constructed like a coil. Commonly used to drain the high-frequency signal leads to the ground. 3. Groups of this type are formed from a number of distinguished capacitor dielectric material is a layer of metal oxide. The electrode is formed of aluminum components that wear thin membrane that oxidation. This capacitor is used in the timer circuit, low pass filter and power supply circuit. 4. This capacitor has a high degree of stability. This component is usually used for the filter for high frequency and this resonant circuit using a voltage of eminence like a radio transmitter which has a transistor tube. Then the correct order based on the functions and characteristics of the above is ... a. Capacitor tantalum, ceramic capacitors, electrolytic capacitors and capacitor mica b. Capacitor fixed, variable capacitor, electrolytic capacitor and capacitor tentalum c. Mica capacitor, electrolytic capacitor, the capacitor and the variable capacitor tentalum d. Capacitor tentalum, fixed capacitor, electrolytic capacitor and a ceramic capacitor e. Electrolytic capacitor, variable capacitor, mica capacitor and capacitor tentalum **Give your reasons: ....**	3
Hypothesis	***Students are able to determine the hypothesis of the***	4

skills	***influence factor inductors Inductance.*** Factors that affect Inductance an Inductor (Coil) is ... a. the higher the less windings Inductance, The smaller diameter of the higher inductance, permeability core, the core material used as Air And the longer the inductor (coil) The higher the inductance. b. the higher the less windings Inductance,, The smaller diameter of the higher inductance, permeability core, the core material used as Air And the shorter the inductor (coil) The higher the inductance. c. the higher the less windings Inductance,, The larger the diameter the less the inductance, permeability core, the core material used such as Air, Ferit And the longer the inductor (coil) is getting smaller inductance. d. the higher the more windings Inductance,, The smaller the diameter, the greater the inductance, permeability core, the core material used such as Air, iron or ferrite And the shorter the inductor (coil) The higher the inductance. e. the higher the more windings Inductance,, The larger the diameter the higher the inductance, permeability core, the core material used such as Air, iron or ferrite And the shorter the inductor (coil) The higher the inductance. **Give your reasons: ....**	
Communication Skills	***Students are able to communicate the images into graphics*** Four lamps (TL) of the same, first sequenced as shown 1. Then by a student is turned into a series of such images 2. If the flame to four lights from both the circuit properly observed, then the light changes flash strobes can you describe such as bar charts: .....   **Give your reasons: ....**	5
Predictionskills	***Students are able to predict accurately the relationship v and i.*** Suppose you want to examine the barriers of an incandescent bulb 10V, 20W by making changes to a maximum voltage of 10V and a hefty current record changes. Based on the factors that may affect large wire resistance, then your estimate of the	6

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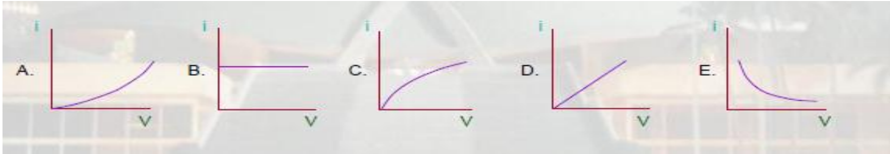
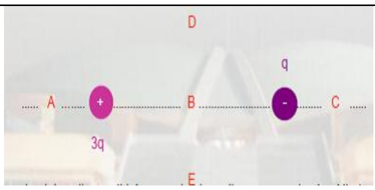
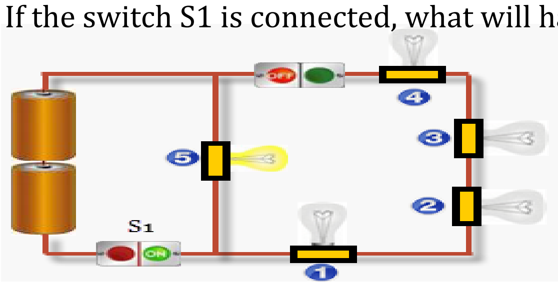
	current strength graph (i) a function of voltage (V) of the study is as shown:  **Give your reasons: ....**	
experimentS kills	***Students skilled in conducting experiments*** 1. If the equipment and materials supplied AC Lamp 5 Watt 3 pieces, 1m cable, on-off switches, steckker, lamp socket, cutter, screwdriver and testpen. 2. Compose off switch on in parallel and three lamps in parallel and chain STECKER and wired in series 3. Compose the on off switch in series and 3 lamps and parallel STECKER 4. Turn on the power source Then the correct instructions for stringing lights in parallel A. 1, 2 and 3 C. 2, 3 and 4 E. 2, 3 and 4 B. 1, 3 and 4 D. 1 and 4 **Give your reasons: ....**	7
apply theconcept skills	***Students skilled in applying the concept***  At first there were two charges were not similar and not as great as the picture is put. In order for other cargo that is not experiencing the resultant q coulomb force due to the influence of the two charges, then charges should be laid q: ..... a. On the left charge = 3q (around point A) b. Among charge = 3q and q (around point B) c. To the right of the charge q (around point C) d. Above between payload = 3q and q (around point D) e. Under the charge + 3q and q (approximately point E) **Give your reasons: ....**	8
Observation skills	***Students observed the arrangement of lamp inelectrical circuit.*** Consider the following picture electrical circuit! If the switch S1 is connected, what will happen is ...  a. all the lights on	9

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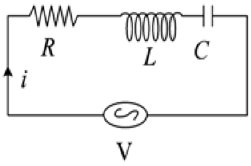
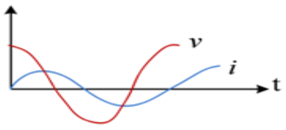
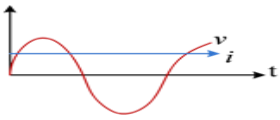
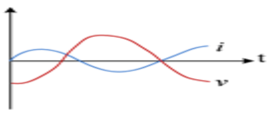
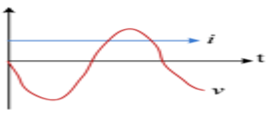
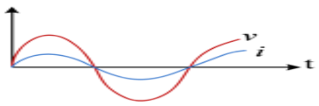
	b. all the lights went out c. 5 lamp is lit, the lamp 1, 2, 3, and 4 outages d. 5 lamp outages, lights 1, 2, 3, and 4 lit. e. all the lights went out **Give your reasons: ....**	
Communication Skills	***Students are able to communicate the images into graphics*** Note the picture below, circuit R - L - C are arranged like the picture on the side.Graph of sine wave if XL> XC is  a.   b.   c.  **Give your reasons: ....**	10

The Development of Authenic Assessment for Supporting the Research-based Physics Learning in SMAN 3 Bukittinggi

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Abstract

Physics learning in Senior High School (SMAN) 3 Bukittinggi implemented with theoretical and practicum. Learning process was still centered on the teacher. Supporting facilities such as laboratory and equipments have been available in SMAN 3 Bukittinggi, but has not been used optimally. Teacher was not used authentic assessment. Most of the students have not masteredthe physics lesson. Research-based learning was one the learning model to improve students' competence. To know the students' competence in physicslearning, required authentic assessment. Authentic assessment consists of the performance assessment, project, and portfolio. This research aims to develop theauthentic assessment that valid, practical, and effective to support the research-based physics learning. Research and development used the 4D model of Thiagarajan.The data collection was used a validation sheet, observation sheets, questionnaires, performance assessment sheet, project assessment sheet, portfolio assessment sheet, and achievement test. The results showed that the authentic assessment was included the valid category, based on expert judgment. Practicality of authentic assessment was included the practical categories, based on the observation, responses of students and teachers. Authentic assessment was effective based on; the studentcognitive,studentsperformance, and students attitudes that obtained from the authentic assessment was included the good category.
Keywords:*Authentic assessment, research-based learning.*

INTRODUCTION

Education goals to develop students' competencies through their active role in learning so that students are creative, independent and able to live in a society. This is in accordance with national education goals, which is to the intellectual life of the nation, noble character, noble and able to compete in the life of the international community. The life of the international community not only affect the economy but also affect educational change. This change requires governments to make the arrangement of the education system completely and thoroughly, especially related to education quality and suitability to the needs of society and the world of work. This arrangement through improving the quality of education. In addition, the arrangement of education should be adapted to the environment of life and the needs of students, especially in mastery of the subject matter.

Mastery of the subject matter in the learning of physics can support the promotion of human resources, because basically physics is the science that studies the phenomena of nature, the interaction of objects in nature that is based through observation. Physical phenomena can be found easily in daily life. In physics learning, the students can be observation and experimentation so as to find or prove the theories independently. The learning process that emphasizes providing direct experience helps students to understand more deeply about the natural surroundings so that enhance their ability in solving various problems. Increased understanding leads to problem-solving ability is an important aspect in creating a quality learning and more meaningful.

The government has made many efforts to improve the quality of learning so that more meaningful. One of the government's efforts to make improvements to the curriculum. Curriculum of 2013 aims to prepare students to have the ability to live as individuals and citizens who believe, productive, creative, innovative and able to contribute to the society, nation, state and world civilization (Permendikbud No. 70/2013). Curriculum of 2013 was designed to develop a balance between the spiritual and social attitudes, intellectual abilities and skills that implemented in the learning process.Completion of the curriculum that the government was also matched by efforts to improve the performance of teachers in the learning process.One of them by implementing teacher certification program and teacher professional education for prospective teachers. Through this program is expected to produce teachers who are competent in the pedagogic aspects, personal, social and professional. This government effort is supported by research in education. Education research is useful for problemsolving in learning and can help improve the quality of education. Research conducted by Festiyed (2015) concerning the integration of the scientific approach and authentic assessment in science learning can be develop the soft skills of students. Research conducted by Usmeldi (2015) concerning the development of research-based student worksheet proven effectively used in learning physics. The implementation of research-based physics learning with a scientific approach to effectively improve science process skills and learning outcomes of students (Usmeldi, 2016). These research enhance government efforts so as to realize the ideal of physics learning and in accordance with national education standards.

The fact that government efforts have yielded disappointing results as expected. The learning process as appropriate to the curriculum of 2013 in general has been applied to several schools, but not optimum implementation. This is evidenced by the use of the scientific approach is not optimum, because the lecture method still dominates in the learning process. In addition, the assessment form has not been in accordance with the curriculum of 2013. Authentic assessment has not been carried out by the teacher. Suastra (2005) mentions that the non-realization of authentic assessment by teachers is because the teachers did not understand any aspects that should be assessed, how the assessment procedures, and how to process the results of assessments.Assessment coducted the teachers still the exam at the end of each subject in the form of multiple-choice and essay tests. It has not been in accordance with the assessment standards in curriculum of 2013, so that is necessary to develop authentic assessment. Authentic assessment aims to monitor the process, the progress of learning and improving the student learning outcomes. All students competencies such as knowledge, skills, and attitudes can be assessed as a whole in learning.

Before designing the authentic assessment, survey was conducted to obtain information about the needs of the development of authentic assessment. Infrastructure and school policy has been good to realize an efficient learning. Teachers were able to make theteaching materialsproperly, but the implementation has not been a student-centered learning. Lecture method still dominates in the learning process. Students have difficulty in learning. Students are not able to be responsible towards their task and have not the discipline. The delay in collecting the tasks. Students' learning difficulties have an impact on the mastery of their learning outcomes, especially in the cognitive domain. The average percentage of mastery of the students learning in the class X MIPA at SMAN 3 Bukittinggi in the first semester of the 2015/2016 was 34.3%.This condition shows that the most of students have difficulty in solving the problem of physics.

Based on the survey that has been done, the assessment needs to be developed that is integrated with the implementation of learning. One assessment to assess students' competencies in learning physics is authentic assessment. Implementation of authentic assessment of learning requires learning model that can lead students to find solutions to problems are given. One model of learning that can lead them from finding the problem to be able to solve these problems is a model of Research Based Learning. Learning with models of research based learning can stimulate scientific thinking of students. Learning activities begins with the build understanding through real examples in life, formulate the problem, and then train them for information, draw up a hypothesis, collect data, analyze the data and conclude. Using this model of learning activities help students gain a better knowledge so that they are able to solve physics problems.

Research-based learning model is one of the student-centered learning models that integrate research in the learning process. Learning based on research conducted in a wide variety of learning methods. Research based learning gives students the chance to search for information, draw up a hypothesis, collect data, analyze the data and make inferences (Wardoyo, 2013). All the learning outcomes that are owned by the student comes from a study (study) simple they do, for example, through experiments and field studies. With the implementation of research based learning students are expected to have the character of a scientist (scientist). The character is marked by a high curiosity, unable to solve problems, to think systematically, objectively, and has a strong idea. Research is an important means to improve the quality of learning. Research component consists of; (1) the background of the problem, (2) formulation of the problem, (3) the execution procedures, (4) the results of the research, (5) discussion, and (6) the publication of research results. It is believed to increase the quality of learning. Research based learning is an instructional strategy that uses authentic learning, problem solving, cooperative learning, contextual, and inquiry approach (Roach, 2000).

In research based learning required assessment models appropriate to the learning characteristics. With reference to the characteristics of learning in the laboratory where students are directly confronted with real problems and learn the patterns of cooperation to resolve the problems faced, the right type of assessment to be developed is the authentic assessment. Inger (1995) suggested that the assessment of authentic produce more valid information about the results of the education program compared to the information provided by traditional testing procedures. Authentic assessment models to be used, because the scoring model can measure students' abilities and skills. Badmus (2007) suggested that to improve the quality of assessment results and the quality of learning is to use authentic assessment. The reason is that the assessment is appropriate in authentic learning using the reference benchmark assessment, which emphasizes the cognitive assessment, performance, and attitude. From the results of the review of literature, authentic assessment consists of several types, such as performance assessment, project assessment, portfolios, journals, and self-assessment.The problems in this research are: (1) How is the development of authentic assessment to support Research-based Physics Learning? (2) How validity, practicalities and effectiveness of authentic assessment developed? The research aims to develop authentic assessment of learning physics research based valid, practical and effective.

METHOD

Design research using methods of research and development, which refers to the four-D models. According to Thiagarajan (Trianto 2009) the four-D models stage is define, design, development, and dessiminate. The subjects of the study is the authentic assessment in learning physics for high school students. Respondents were students and teachers of physics at SMAN 3 Bukittinggi. Data collection instrument was a validation sheet, observation sheet, questionnaire, performance assessment sheet, project assessment sheet, portfolio assessment sheet, and achievement test. Data validation of authentic assessment were analyzed with descriptivestatistics and compared with the validity criteria. Questionnaire data were analyzed quantitatively to determine the practicality of authentic assessment. The implementation data of authentic assessment was analyzed qualitatively by revising procedures and authentic assessment items. Revisions were made based on records researcher and observations conducted by the observer on the implementation of authentic assessment.

RESULT AND DISCUSSION

In a preliminary study found that most teachers do not understand the authentic assessment. Teachers have not conducted an assessment of the portfolio because too much time, especially in the preparation of scoring guidelines and implementation of the assessment. Implementation of authentic assessment using various forms of assessment, namely performance assessment, project assessment, portfolios, journals, and self-assessment.The characteristics of performance assessments not only assessingthe student learning outcomes, but give the complete information about the learning process. In other words, the performance assessment that accompanies process in the student learning activities.The performance assessment required the scoring rubric. Rubric made based on the assessment goals and this rubric is communicated to the students so that they can demonstrate their ability. The use of an assessment rubric to help teachers to assess student performance more accurately and objectively.

Based on the results of the forum group discussion, the content aspect 92% of teachers saidauthentic assessment was good categories, 8% said very good. From the construction aspect 89% of teachers said very good and 11% said good. In thelanguage aspect 85% said good and 15% vary good. Wilde (Padmono, 2006) said the implementation of authentic assessment requires the ability of teachers to modify the information used to plan learning activities. Teachers should not usedthe traditional assessment, but teachers can make an innovation assessment to improve the quality of student learning. The traditional assessments have tended in the assessment of cognitive aspects while affective and psychomotor aspects have not conducted.

The suggestions obtained through the forum group discussion accordance with the concept of assessment by (Brown, 2004) that the tests should be conducted as naturally as possible, meaningful topics, relevant and interesting to students andtasks that are given around the lives of students. Authentic assessment is an process assessment which involves the performance that reflects how students achieve competence in learning. Wiggins (2012) gives students a set of tasks that reflect the priorities and challenges encountered in the learning activities: conducting of the research, writing, revising and discussing articles. Implementation of authentic assessment in research based learning engages students more active in conducting research and teachers can be confident that the results of the assessment can illustrate the students' actual ability.

Results of Authentic Assessment Validation

Before conducting the field tests, authentic assessments validated by two experts in education, to determine validity the design of authentic assessment. The validation results can be summarized in Table 1.

Table 1. Results of Authentic Assessment Validation

No	Validated Components	Validity	
		Index	Conclusion
1	Performance assessment	0.8	Valid
2	Project assessment	0.87	Valid
3	Portfolio	0.69	Valid

4	Journals	0.93	Valid
5	Rubrics	0.76	Valid
6	Self-assessment	0.90	Valid

Based onthe information presentedin Table1, note that the authentic assessment already qualified validity. The expert assessment is based on theoretical knowledge and their experience.

Results of Field Test the AuthenticAssessment

Field test activities in this research were conducted three times, which consists of individual testing, small group trial, and the trial was expanded. Test individuals and small groups are intended to identify problems that could hamper feasibility authentic assessment, such as readability, language, and the time required by students and teachers, so that it can be revised to obtain the authentic assessment that the practical categories. Based on the results of these trials carried out revisions to the authentic assessment to obtain a better authentic assessment. The results of the data analysis of the practicalities of authentic assessment by teachers obtained the teacher's response to the authentic assessment is the very good category with an average value of percentage is 87.2%. Thus, it can be concluded that the authentic assessment is practical category.

Authentic assessment used in research-based physics learning. Effectiveness of authentic assessment in terms of student learning outcomes in research-based learning. Assessment is done on aspects of the cognitive, psychomotor and attitude, as in table 2. The average student learning outcomes in cognitive, psychomotor and affective was good category. This shows that the authentic assessment in research-based physics learning effective to improve the competence of students.

Tabel 2.Learning Outcomes in Research-Based Physics Learning

Face to	Cognitive	Psychomotor	Affective
1	72.2	75.8	79.4
2	78.6	80.1	83.1
3	86.5	87.6	85.9

Discussion

The results of the needs analysis to the develop of authentic assessment in SMAN 3 Bukittinggi indicated that the authentic assessment in physics learning has not been implemented. It can be seen from the following findings. The assessment of student learning outcomes is focused on cognitive aspects. Almost all students (90%) stated that the assessment is done with paper and pencil test, either in the form of objective tests and test essay.Non-test that should be used to assess the performance and attitudes of students in learning is not used by the teachers. This will make it difficult for teachers to assess students' competencies in affective and psychomotor aspects. Tests that have been used in assessing learning outcomes is still dominated (78%) with a multiple-choice test. The use of these tests would not give more opportunities to the development of creative thinking of students. Another thing that is found in need analysis is the quiz block tests are still relatively small. In the case, the class assessment, it should be done continuously during the learning process. The impact of not continuous assessment that a teacher will have difficulty in making a decision at the end of the semester.

The field test results show that consistently authentic assessment that developed in physics learning was positive impact on students' learning outcomes. Learning outcomes in the form of basic competencies consistently showed improvement. The students' response to the development of authentic assessment, showed a very positive response. This means that the physics learning with authentic assessment was responded very positively by the students. Students felt that with a comprehensive assessment (cognitive, psychomotor, and affective), are continuous, transparent it can motivate student learning.These findings indicate that the development of authentic assessment in physics learning through research-based learning is effective to improve the studentscompetence. This is consistent with the main function of authentic assessment that help students to achievethe expected competencies and determine the level of achievement of these competencies (Depdiknas, 2005; Setiawan, 2012; Marhaeni, 2015). Furthermore, Arend (2000), Doran (1998), Hart (1994), Wijayanti (2014), and Depdiknas (2005) emphasizes that the benefits of authentic assessment, among others encourages students actively involved in problem solving and work meaningfully in everyday tasks and enables students to effectively utilize their knowledge to solve the real life problems. Therefore, teachers need to continue to develop authentic assessment in physics learning because it can motivate students to learn and ultimately will impact the learning outcome.

The instructional with authentic assessment, although it has had a pretty good contribution, in implementation on the ground facing some obstacles. The most prominent constraint is the number of students is relatively large (approximately 40 students) will make it difficult for teachers to provide an assessment, especially concerning the observation of student performance. However, these difficulties have been overcome by focusing on a few votes alone groups (2 to 3 groups), while the other group was observed at the next learning. Another constraint is the number of sets of tools that exist in each school is still inadequate. The minimum standard laboratory equipment that must be owned by the school is 10 sets of experiments. Thus, the experiment will be done by 4 students so that an assessment will be carried out optimally.

CONCLUSION

Based on the field testing that has been done, the conclusion as follows:

1. Assessment authentic to assess the competence of students in the physics research based learning using various forms of assessment, namely performance assessment, project assessment, portfolios, journals, and self-assessment.
2. Performance assessment is equipped with arubric. Use rubriccan help teachers assess student performance more accurately and objectively.
3. Authentic assessment is valid based on expert judgment.
4. Authentic assessment including very practical categories based on the response of teachers.
5. Authentic assessment including effective based on the student learning outcomes in the cognitive, skills, and attitudes.

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A Model Development of Mathematics Learning Think Create and Apply Based Constructivisme at Madrasah Aliyah

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Abstract

The preliminary study on mathematic classes in MAN Olak Kemang Jambi and MA Laboratorium Jambi, reveals that the instructional process and materials that teacher use not yet facilitated the students to construct their own meaning in mathematic. The effectiveness of mathematic learning was low and learning process was techer centered. So that it need for a development of mathematic based constructivisme model. The purpose of this research were to develop a model of mathematic at Madrasah Aliyah. A design research was conducted to develop A Model Development of Mathematics Learning Think Create and Apply Based Constructivisme (MTCAC) at Madrasah Aliyah adapted from the model suggested by Plomp (2013). The design research phase adapted phese involved preliminary reseach prototyping phase Qualitive and assesment phase. The research data were qulaitative and quantitative. Qualitative data were collected thorugh observation and qiusionares and quantitative data were obtained by using a test and observation.
Keywords: mathematic, design research, MTCAC

INTRODUCTION

Based Permendiknas 69 In 2014, the subjects of mathematics intended for high school students / MA / SMK / MAK has the ability, (1) understand the mathematical concept, is competence in explaining the relationship between concepts and uses concepts and algorithms, flexibly, accurately, efficiently, and accurately, in solution to problem; (2) using the pattern as alleged in the resolution of the problem, and was able to make generalizations based on the phenomenon or the existing data; (3) using the reasoning on the nature, perform mathematical manipulations both in simplification, as well as analyzing the existing components in the solution of problems in the context of mathematics and outside mathematics (real life, science, and technology) covering the ability to understand the problem, build a mathematical model, finish models and interpret the obtained solution, including in order to solve problems in everyday life (the real world); (4) communicate ideas, reasoning and able to devise mathematical proofs using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem; (5) have an attitude appreciate the usefulness of mathematics in life, are curious, attention, and interest in studying mathematics, as well as a tenacious attitude and confidence in problem solving; (6) have the attitude and behavior in accordance with the values in the math and learning, such as obey the principle, consistently uphold the agreement, tolerant, respect the opinions of others, polite, democracy, tenacious, resilient, creative, appreciate the universality (context, environment), cooperation, fair, honest, conscientious, meticulous, etc; (7) of the activities of motor that uses mathematical knowledge; (8) using simple props as well as the results of the technology to perform mathematical activities.

Based Permendikbud No. 69 of 2014 above is understood that the role of mathematics very great improvement in the quality of human resources, must be supported by an approach and learning model that provides opportunities for students to be able to see, feel, solve their own problems in their lives day-math day, so that students will be more aware of the importance of learning math. When students are dealing with mathematical problems, they realize that it can be seen from different angles. This means that they realize that to solve these problems, they should be able to construct knowledge creatively to problem-solving, integrating ideas concepts of knowledge from different disciplines that he has. Reality on the ground learning goals is apparently still not fully achieved. These conditions give rise to complex perceptions of the mathematics itself is difficult to develop mathematical ability, the quality of learning outcomes low math. Students looked at mathematics as a subject that is complicated, not motivated, very boring, less useful / meaningful and does not give room for them to activity and creativity. In fact, mathematics is one of the subjects tested in the national examination which is a requirement of students graduating from elementary school, junior high, or high as the benchmark of ability and quality of students.

Based on the pre-survey conducted on the two schools be concluded that teachers who are experienced and have been training on innovative learning still difficult to manage learning needs and abilities of students. These findings indicate students are less able to solve problems on their own, less able to construct the existing capabilities inside because it was used by the examples that have been given by the teacher and if students forget the formula, students are not used to thinking creatively, and can not apply knowledge gained to other problems as well as a quitter. This condition indicates that solving abilities and habits of thought or the Habits of Mind (HOM) students are still very low and can not solve problems that require the ability to think critically or Higher Order Thinking (HOT). This is presumably due to the conventional approach, which is still used by teachers, resulting in students depending on the procedure rote to solve the problem, follow the pattern and model of procedures similar to what has been described by the teacher or in textbooks, so that when students are faced with the problem others are not the same as an example, students are difficult to solve. Students are less capable of solving this problem occurs because the concentration level students who are not up in the following study. It may be caused due to the methods used do not match or the method does not make students interested in so that most students are less able to solve the problems associated with such materials. Based on some of the issues that have been presented above, it therefore needs to be made a model of learning that Learning Mathematical Model Development Think Create and Apply Based constructivism (MTCAC) or simplified according to the needs of students. MTCAC is made to enhance learning model TPS and TTW earlier as described previously. MTCAC a cooperative and collaborative learning based on constructivism as a group that gives students the opportunity to think creatively solve mathematical problems in accordance with the experience and ability of each was then given the opportunity to implement new ideas that he gets to the point given by the teacher beforehand. MTCAC emphasis on students' own creativity in solving problems together (collaborative). MTCAC guiding students have the responsibility of individuals and groups. There are three stages in this MTCAC ie Think, Create and Apply. At this stage of think (think), the teacher gives the student a question or problem. Teachers give a few minutes to think about the answer that the students are accustomed to think before removing ideas from personal experience. Students think independently seek the answer Stage create (create / make), after the students were asked to be creative thought out ideas of yourself and then discuss with the group's friends, teachers give students the freedom to construct pengetahuanya, give and take other people's opinions. Stage apply (implement), after discussing the results of his thinking and generate new ideas and then those ideas are applied to per masalahan the teacher. The reason why MTCAC is needed by students this case some teachers also supported by questionnaire of needs analysis provided to some teachers because internal requirements for madrassas that their MTCAC with 3 books supporting products: Books Rational Model, Handbook for Teachers Working and Handbook for Student Work or Student Worksheet (LKS) so it will be easier to understand textbooks. Therefore MTCAC generated through research and development (design research), have three things: (i) profit, (ii) scope, and (iii) the depth, can be accounted for. Development of research in mathematics learning level MA / senior high school is a relatively new phenomenon, including research on the development of Mathematics Learning Model Think Create and Apply Based constructivism (MTCAC). Though the problem in mathematics education that can not be solved only by experimental research on strategy or method of learning. Therefore, the perceived importance of doing research and development under the title "Development of Mathematics Instructional Model Based Think Create and Apply constructivism ".

Reasearch Problem:
1. What is the shape of Mathematics Instructional Model Development of Think Create and Apply-based constructivism are valid, practical, and effective?
2. How is the picture of the students' activities during MTCAC ?

Product Specifications Expected

Products from the results of this development is a Mathematics Instructional Model Think Create and Apply documented in book form. This book includes aspects related to Mathematics Learning Model Think Create and Apply optimized emerging learning principles MTCAC mathematical models to improve learning effectiveness. There are five components that are used and serve as elements penyusunannnya is syntax, the social system, the principles of reaction, and the impact of instructional support system and escort.
Specifications of the five components are as follows:
1. Syntax, in essence measures applied learning to develop students' thinking to make learning activities more meaningful, solve problems, find and construct prior knowledge.
2. The principle of the reaction, will explain how teachers facilitate the learning process, providing guidance and responding to what students can do.
3. The social system, will explain how the role and the relationship between teachers and students as well as the underlying rules.
4. The support system is the Master Manual Work, which is a guide for teachers in managing learning that also contained herein Learning Implementation Plan and the Handbook for Student Work or Student Worksheet. This model produces a documentation of a book that comes with activity guides for teachers and guides for students working in the form of syntax or steps in the learning process. This is to establish a social system between teachers and students in their respective roles, strengthening the role of the teacher as a facilitator, mediator and teacher responses to the learning needs of their students. The problem with the model will facilitate the planning and implementation of mathematics learning tasks that have a lot of coverage, so as to develop students' mathematical abilities. Development of Mathematics Instructional Model Think Create and Apply is limited to the development of guidelines in the form of teacher assignments and student work as well as documentation guides learning model in the form of a textbook. Learning materials developed material focused on high school students / Madrasah Aliyah class X the second half and only done in one semester. The development of this model refers to and uses several sources of theory and the results of studies by experts before being adopted and adapted to the needs of research Construction of model development is based on the opinion of Joyce & Weil (1992), Iru, La and La Ode Safian Arihi (2012) and Kemp , Jerrold E. et al (1994). Model development using design Plomp (2010).

LITERATURE

Constructivime is one philosophy that emphasizes knowledge that our knowledge is construction (formation) our own (Von Glasersfel in Suparno, 1997: 18). Opinion was explained that, man must construct knowledge and give meaning through real experience, so that knowledge becomes meaningful in his life. Learning by constructivism is "Process menasiliminasikan and connecting experience or materials are studied with the understanding that already belongs to someone so understanding was developed" (Suparno: 1997: 61). So we can conclude that learning is the student activities menkonstruksi knowledge with the knowledge and experience already owned.Based on the nature of knowledge and the essence of constructivism, the structure of one's conception can form a conception of knowledge when it applies and dealing with the world experiences nyata. Tugas educators are here not only to pour or transfer the amount of information or concepts, but see to it that these concepts are useful in life and terkoneksikan with prior knowledge of students. Quality Learning Model Nieveen (2013) explains, the quality of learning in developing research models determined by the criteria of validity, (validity), practicality (practicality), and effectivenees (effectiveness). a. Validity Learning Model Nieveen (2013: 160) in Nana S (2014: 32) states relevance is a need for intervention and refers to the design level of intervention that was developed based on the state of the art knowledge disebutjugavaliditas content and consistency meant that the various components of interventions logically linked between one with other so-called construct validity.Model-based constructivism learning mathematics concluded valid if developed with adequate theory, called the validity of the content. All components of the learning model, with one another in touch with consistent, is called construct validity b. Practicalities Learning Model Nieveen (2013: 160) in Nana S (2014: 33) states the model of the development is said to be practical if the model is expected to be useful for any field in accordance with the model developed. Akker (2013: 66) in Nana S (2014: 33) states practicability refers to the opinion of practitioners and experts say that the model is clear, usable and effective in normal conditions.

So it can be concluded that the practicality of learning model is determined by user votes or practitioners. Rate practicality by the user or wearer, seen in the answers: (1) whether the practitioner believes what was developed can be used in normal conditions; and (2) whether the fact shows that what is developed that can be applied by practitioners. c.Efektivitas Learning Model The model developed should be evaluated to improve the quality of the model. Evaluation techniques were implemented within a formative evaluation Tessmer (1993) in (Plomp, 2013: 36), namely assessments (self-evaluation), assessment expert (expert review), assessment of one-to-one (one-to-one evaluation) , assessment by a small group (small group evaluation) and field trials (field tests).Based on the concepts of evaluation of the learning model, which is used to express aspects of the quality of the model in this study are: 1) the validity based constructivism learning model mathematics is determined from the results of the expert assessment of the prototype. 2) Practicality constructivism learning model mathematics is determined based on the results of students, practitioners (teachers), the prototype, and the observations of the learning process.3) The effectiveness of mathematics teaching model based on constructivism determined from the learning aspect of mathematical abilities, habits of mind of students, student activity observation and interviews with students and practitioners / teachers. Learning Math National Council of Teachers of Mathematics (NCTM) (1999) also explained that the purpose of learning mathematics is to develop the ability to explore, construct a conjecture; and arrange reason logically, ability to solve problems is not routine; the ability to communicate mathematically and use mathematics as a tool of communication, the ability to connect between mathematical ideas and between mathematics and other activities. Ability is called the power of mathematical process or mathematical ability. Troubleshooting Capabilities Problem solving is a basic ability that must be mastered by will siswa.Tuntutan problem-solving ability is emphasized explicitly in the curriculum that is, as the basic competencies that must be developed and integrated in a number of appropriate materials.

Habits of Mind (HOM) Out come in the form of education (educational outcomes) consists of four levels. The first level master specific content, the second level thinking skills mastering, mastering third-level cognitive tasks that require full thinking skills, and the fourth level thinking habits.

The first level of educational outcomes is the mastery konten.Terdapat some questions to illustrate mastery of the content. Questions regarding content or material of an pa who want to be mastered by students, what should be controlled by teachers so that students can master the material, and assessment of what should be given so that the teacher knows the extent to which students master the material. The second level is the master of thinking skills. Mastery of content or material is not an end in the learning process. The curriculum should also pay attention to thinking skills that must be mastered by siswa.Keterampilan think can grow and develop in the students through student activity during pembelajaran.Bentuk activities such as observation, hypothesis and experiment before drawing a conclusion.

Activities need to be well recognized by siswa.Siswa should be aware of when making observations and collecting data, formulating and testing hypotheses, before drawing any conclusions. Awareness of the students are in training provision and implement processes that are required in critical and creative thinking. Activities of students in drawing conclusions in drawing conclusions based on certain rules is a process in train the ability to think logically (Costa and Kallick, 2009). Questions relating to the control ketermapilan thinking is the process of what to do by teachers so that students can be trained and develop their thinking skills. Ideas or strategies that emerged from the students in problem solving. How can teachers provide learning so that students master the skills to think and at the same time as the process of habituation do.

The third level is associated with education outcomes is a demanding cognitive task penuh.Level thinking skills can progress through several activities during the learning berlangsung.Aktivitas begins by presenting the problem. Form of the issues presented is not known the answer, but requires strategic thinking, planning, creating something new, make decisions, resolve disagreements that may arise, do research and test theorems and construct meaning in other phenomena given. The problem presented by the teacher should be designed in such a way, so that students master ini.Respon level students should be predictable and it is anticipated that the teacher can lead to the creation of new knowledge. What assessment tools should be designed to fit to measure the ability to think. All these activities require planning and design sbelumnya designed by the teacher. If it escapes from teachers and students will produce knowledge.

The third level educational outcomes is essentially a student's ability to give to eat every learn. Activity of the student experience thirst generating new knowledge, and become a habit of thought known as HOM (Costa and Kallick, 2009). The fourth level of education outcomes is HOM. There are six habits that are included in the HOM. The habit of thinking is a habit of thinking flexibly, familiarize ask questions, solve problems effectively habit, the habit of using the masala knowledge to new situations, to get used to communicate, think clearly, precisely, using all the senses when gathering information, trying different ways and generate ideas were new ideas, a habit to respond, the habit of taking risks, the usual charge, have a sense of humor, familiarize think interactive with others, to be open and try constantly (Costa and Kallick, 2009).

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The study of the HOM described also by Marzano and Pickering as one level in the dimension of learning. Learning dimension is a comprehensive model, using the results of research and learning theory to determine the learning process will be done. Dimensions of learning is also known by the five dimensional level thinking skills. Dimensions of learning is very important in determining the success of the learning process. Dimension learning helps teachers, in order to stay focused on learning, learn about the process of learning continues to be used, do a lesson plan, and memeprtimbangkan appropriate type of assessment. There are five types of learning dimensions according to Marzano. The first dimensionabout attitudes and perceptions can affect students' learning. Students feel happy, peaceful and safe in their learning environment, then it would achieve better success, compared with students who have a negative impression. The key point in this dimension is the role of the teacher urntuk manage learning in order to have an impact on the attitudes and positive perception of students.

The second dimension is to acquire and integrate knowledge. Teachers should help students to use prior knowledge that susdah owned and connect with new informas. This process does not stop here, the teacher must try to pengeatahuan newly formed can be stored in long-term memory of students. The third dimension relates to expand and improve pengetahuan.Belajar not stop until obtaining and integrating pengetahuan.Siswa should develop a deeper understanding and enhance knowledge. Students must analyze and apply what they gained in learning. This activity can be done through the process of comparing, clarifying, mengabstrak, inductive reasoning, deductive reasoning, build support, perform analysis.The fourth Dimension is to use knowledge bermakna.Teori already should be applied in everyday life. This can be done through six ways. These ways are decision making, problem solving, discovery, experimentation, investigation and analyzing a system. The fifth dimension dalah thinking habits. Students who have been able to develop the capacity to think it allows them to have Traffic critical thinking, creativity, and can adjust their behavior (Marzano and Pickering, 2003).

At first the teacher's role is flexible in the classroom is very difficult to do, and unacceptable by student. Student can not accept the teacher's behavior, when they find it difficult or failure in finding the answer, the teacher did not immediately confirm the solution. Teacher behavior to accept the diversity student answer with other students often can not be accepted also by some students (Lloyd, 2009). This study was about HOM growing and developing on students after they have a math learning. The model used is a mathematical model of learning based Think Create and Apply Constructivism(MTCAC).

Research hypothesis. The hypothesis of this study are described based on the formulation of the problem which has been described in previous chapters. The hypothesis of this study as follows.

1. There is a difference between the problem solving ability of students to apply their learning Mathematics Learning Model Think Create and Apply Based constructivism (MTCAC) with students learning to apply conventional learningmodels.
2. Mathematical problem solving ability of students who take MTCAC better than students who take understandingofconcepts.

RESEARCH METHODS

This study is included in the design of educational research with the type of development studies. Because the goal of this research is to develop a Model of Learning Math Think Create and Apply based constructivism. This type of research also with the term research and development. Simpler definition according Sugiyono (2011: 407) on research and development is a research method that is used to produce a particular product, and test the effectiveness of the product. Products produced in this study were Mathematics Learning Model Think Create and Apply based constructivism are valid, practical and effective. Development of Mathematics Instructional Model Think Create and Apply based constructivism (MTCAC) uses design development Plomp (2013: 19), which has three stages or phases, namely:

1.PreliminaryResearch
2.PrototypingDevelopmentPhase
3.AssessmentPhase

Based on the three-phase development procedure according to Plomp (2013: 19), then the form of activities undertaken in the development of MPM-TCAC shown in Table 1 below. Table.1 Mathematics Learning Model Development Phase Think Create and Apply based constructivism (MTCAC)

No	Developmen t	Activities	Description
1	*Preliminary Research*	Need Assesment Analysis and complex	Investigation outset the need for Mathematical Learning Model Think Create and Apply based constructivism
			Analyzing the purpose and content of mathematics courses
			Analyzing student charachteristic
		Review Literatur	Analyzing Literature Review theories and concepts associated with Mathematics Learning Model Think Create and Apply based constructivism
		Development Framework Conceptualan d Theory of Design	Design framework and theoretical framework for Mathematical Learning Model Think Create and Apply based constructivism
2	*Prototyping Phase*	Design Prototype	Design Think Math Learning Model Create and Apply based constructivism
		Formative Evaluation	To test the validity of (expert review, focus groups and field test) to prototype
		Revisi	Revision Revise the prototype based on the results of formative evaluation
3	*Assesmen Phase*	Summative Evaluation	To test the practicalities and effectiveness of the prototype

Source:Plomp(2013:19)

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Procedure

1.IntroductionResearchPhase

Preliminary research stage (preliminary study) seeks to analyze the main problems underlying the importance of Mathematics Learning Model Think Create Apply (MPMTCAC). Subject Test Products MA student who is the subject of research is located at Madrasah Aliyah Negeri (MAN) and MadrasahAliyah Laboratory (MAL) in the city of Jambi.

Type of data

The type of data in this study is qualitative data and quantitative.Data results obtained from the discussion, observation / observation, as well as quantitative wawancara.Data obtained from mathematical ability tests, questionnaires and observation sheets. Instruments Research and Development Research Instrument.Instruments used for the preliminary study (preliminary research), testing the validity (prototyping phase), practicality and effectiveness (assessment phase) MTCAC as in Table 2 below:

Table 2 Research Instruments

No	Phase	Research Focus	Instrument
1	Preliminary Research	Needs and Context	Problem initial tests of mathematical ability
2			Format interviews with teachers
3			Format interviews with students
4	Prototyping Phase	Validity	validation Sheets MTCAC book
5			Sheets teacher book MTCAC validation and validation sheet
6			Sheet student book Validation books and sheet validation MTCAC
7	Assessment Phase	practicalities	Implementation of the learning process observation sheetsand sheets validationMTCAC
8			Questionnaire practicalities teacher book MTCAC by practitioners and validation sheet
9			Questionnaire practicalities student book MTCAC by students and sheets validation
10		Effectiveness	Observation sheet student learning activities in MTCAC
11			Questionnaire Habit of Mind of students in MTCAC and validation sheet
12			Problem final test problem-solving ability and validation sheet
13			Format interviews with teachers and validation sheet
14			Format interviews with students and validation Sheet

Data collection technique

Instruments used in the research for this data collection is to use the validation sheet / format validation, observation sheets, interview, assessment sheets, student questionnaire responses, the evaluation sheet.

1. Sheet / Format validation prototype
Format validation arranged to obtain data that represent the content and construct validity of the device / model developed.
2. Observation sheet
Observation sheet is meant observation sheet that can be used to determine the practicalities and effectiveness MTCAC in keterpakaian / keterlaksanaan and activities, kreaktifitas, and productivity of the student.
3. InterviewInterviews were conducted to obtain data information directly from the experts / validator, peers, teachers, education professionals, siswaatau users and are involved in collecting data about the existence of the product.
4. Assessment Sheets / Instrument achievement test
Assessment form in question is a structured assessment sheets MTCAC through the questions that will be used to determine students' mathematical problem solving ability by using MTCAC.
5. Questionnaire student response
Student questionnaire responses structured to obtain data on students' attitudes and opinions towards learning model, students' response to the components, the implementation of learning and students' response to the impact of learning with MTCAC.
6. The evaluation sheet
Evaluation sheet drawn up to obtain data on students' mastery learning as the main data effectiveness. Evaluation sheet is meant sheet evaluation of learning outcomes.
7. Focus group discussions (FGD)
FGD is done so that a device developed in accordance with the purpose it was designed. Reveal the meaning and the needs and problems that become the focus of development, so that it becomes a coherent whole out of a common view of the device developed or the problems examined.

Data Analysis Techniques
Data obtained from various instruments were analyzed by descriptive, qualitative and quantitative in order to identify the learning device developed if it is valid, practical and effective or not. Similarly, to identify whether the teaching materials developed can be implemented in class well and can show the results of students' mathematical abilities.

1. Validity
To test the validity of this model, used the opinions of experts (experts judgment). The validator / experts consulted on the model developed dikembangkan.Validasi include contruct validity and content validity. Construct Validity is suitability model components with predefined elements in the development of content model.Validasi whether models developed is in conformity with the objectives and aspects of the learning set. The results of the assessment of the tools provided with the validator on the analysis steps in the adoption of Muliyardi (2006) which was to determine the mean scores using the formula:
Extensive details:
R=average results ofthe assessment of the experts/validator
V_i= score of the assessment results validator to-i
n= number validator

Then calculated the average of all aspects for the validation of the device by using the following criteria:
1) When the mean of> 3.20 then categorized as very valid
2) When 2.40 <3.20 average ≤ then considered valid

3) When 1.60 <2.40 average ≤ then categorized quite valid
4) When 0.80 <1.60 average ≤ then considered less valid
5) When the average ≤ 0.80 then considered invalid
For the development of this device is said to be valid if the mean values of validator which is pretty valid.

2. practicalities
Data practicality of the device is determined from the assessment results are easy to use, and understood in the implementation of practical learning assessed by practitioners, the implementation of learning by observers and the use of easy to use and perceived by teachers and students. Analysis of the results of the practicality of the steps in the adoption of Muliyardi (2006) which was to determine the mean scores using the formula: with
R = average results of the assessment of the experts / validator
Vi = score of the assessment results validator to-i
n = number validator
Then calculated the average of all the aspects to the practicalities of the device by using the following criteria:
1) When the mean of> 3.20 then categorized as very practical
2) When 2.40 <3.20 average ≤ then categorized practical
3) When 1.60 <2.40 average ≤ then categorized quite practical
4) When 0.80 <1.60 average ≤ then categorized less practical
5) When the average ≤ 0.80 then considered impractical

For the development of this device is said to be practical if the average value of a practitioner who is worth quite practical. To illustrate the use of data on the observation technique described. Questionnairepracticalities of prototype devices with data frequency analysis technique using the formula: For the development of the device is said to be easy to use and understandable if more than 70% of respondents fairly easy / fairly practical.

3. Effectiveness Data Analysis
The analysis of the effectiveness of the device MTCAC result of the activity, response, student learning, and the development of mathematical problem solving ability. For problem-solving skills, using two types of data are the data types of quantitative and qualitative data. Quantitative data obtained from the test results of mathematical problem solving ability and mathematical HOM MA students. The qualitative data obtained from the students' answers. The data obtained are interpreted, and analyzed for the sake of generalization. The data analysis using t-test, ANOVA one lane, ANOVA two lanes, and Chi-Square ($\chi 2$) to determine the influence of factors of learning MPMTCAC towards problem-solving ability and HOM students' mathematical, involving factors Capabilities Early Mathematical and the level of the school. Before statistical tests were prerequisite test, the normality and homogeneity of variance test data group. Testing is done to conclusions. Testing is done for making conclusions about a population based on a sample closer to the truth (Ruseffendi, 993). Normality and homogeneity test using Kolmogorof-Smirnov test and Levene's test.

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The Development of Math Module on Metacognitive Approach Basis for Facilitating The Students' Mathematical Creative Thinking Ability

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Abstract

This research was conducted based on the problem, less learning material utilization of Math module in the teaching and learning process. This research is to produce the Math module on metacognitive approach basis which is valid, practical and able to facilitate the creative thinking Math ability of students. This modul is developed by metacognitive approach, in which the students used this approach for understanding and finishing the problem creativily. This research is a research and development by using ADDIE model (Analysis, Design, Development, Implementation and Evaluation). This research is conducted at Vocational High School Pharmacy IKASARI Pekanbaru. The subject of the research are lecturer and teacher as validator and also the eleventh grade students of Vocational High School Pharmacy IKASARI Pekanbaru while the object of the research is Math module on metacognitive approach basis and students' mathematical creative thinking. The data is gained using validation process by validator, practicality by the students, and test of the students' mathematical creative thinking. The instrument for collecting the data are validation sheet, practicality questionnaire sheet, and posttest. Then, the data was analyzed by using descriptive analysis technique. The module was produced is the module based on metacognitive approach, it had tested by validity degree 83,8% (very valid), practicality degree 81,71% (very practical), and the students' mathematical creative thinking ability 81,09% (high). Based on the result, it can be identified that module which had developed very valid, practical, and high (the students' mathematical creative thinking ability).

Keywords: Mathematical Creative Thinking; Metacognitive Approach; Module.

INTRODUCTION

The degree of students' creativity starts to progress well when they are above eleven years old. Husamah (2013) stated that the characteristics or indicators of creative thinking will be indicated itself in a person comprises fluency, flexibility, originality and elaboration. In the Math learning, the students will be categorized having a good creative thinking if they are able to find and finish Math problems in many ways or various solving and also unsatisfied with the result gained. They always want to develop their thinking with the unique answers and different like usual. Yet, in the field, the students are still cannot to finish the questions creatively, it can be seen from their answers which are stiff, focus on the provided formulation and not different with the teacher's answer.

Utami Munandar (2012) stated that the factors that influence the creativity are age, parents' education degree, provided facilities, and spare time. The providing of the facilities in the learning is providing the learning material. The learning material should be learned by the students autonomously, so that they can learn without teacher and will be organized well. One of the learning materials that can be used is a module.

Andi Prastowo (2013) said that module is a learning material which is arranged sistematically and used the grammar that easy to be understood by the students, it is also appropriate with their knowledge, age degree so that they can learn independently with the help or guide by the teacher. The presenting of the material in the module starts from the general up to the specific one so that the concept is easy to be learned by the students. It is also can be said as the independent learning material. Yet, based on the survey of the researcher at four schools in the Pekanbaru, just one school used a Math module in teaching and learning process. Meaning that, the less of utilization of module in the Math learning at the classroom.

The module that want to developed by the researcher is a modul based metacognitive approach, is that the module which guide the students to use their metacognitive in understanding and finishing a problem creatively. In the reality, learning by using metacognitive approach give the emphasizing on individual's awareness in his/her thinking process self. The awareness of individual's thingking meant is the individual's awareness about a something which is known, done, will be done, and knowledge owned. the learning by using metacognitive approach is one of the ways to increase the thinking ability process and how to think well to solve the Math problem so that the students more active and creative in learning.

Daniel Muijs also stated that metacognitive skill is not only to develop skill in overcoming the problem but also to develop thinking skill commonly. It is line with Martinis Yamin (2013) stated that metacognitive is thinking interpretation that can be applied as a learning strategy to solve the problem. Thus, it is hoped that providing the Math module based metacognitive approach will influence the students to use their metacognitice in solving the problem creatively.

The formulation of the problem of this research is how the degree validity and practicality of Math module based metacognitive approach and also how the degree of the students' mathematical creative thinking after using that modul. The purpose of this research is to develop a product, a learning material in the form of Math module based metacognitive approach which is valid, and practical. It is also to facilitated the students' mathematical creative thinking.

THE METHOD

The kind of this research is a research development. Trianto (2011) stated that Research and Development (R&D) is the set of the processes or steps for developing a new product or completing a previous productin order to do responsibility. In this research, the researcher will develop a product in education field is a Math module.

The model of development that research used in this research is ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Mulyatiningsih (2012) stated that the model of development that will be used to developing learning material, especially module and students' worksheet is ADDIE model. This model can be used for developing many products, for example; model, learning strategy, learning method, media, and learning material. In this research, the researcher do five steps appropriate with ADDIE steps are analysis, design, development, implementation, and evaluation. This research is done at Vocational High School Pharmacy Ikasari Pekanbaru. The subject of the research is the lecturer and teacher as the validator. It is also the eleventh grade students of Vocational High School Pharmacy Ikasari Pekanbaru. While the object of the research is Math Module on metacognitive approach basis and students' Mathematical creative thinking ability.

The technique for collecting the data to determine validity value of Math module on metacognitive approach basis by using validity process and discussion with validator. The technique for knowing practicalitiy value of module is by using interview in the small group and practicality questionnaire in the limited group. Then, the technique for collecting the data for knowing students' mathematical creative thinking is by using a test after finishing of using Math module on metacognitive approach basis. The instruement for collecting the data are validity sheet of module. It comprises with validity sheet by the expert of learning material and education technology expert. It is also practicality sheet, it comprises with the guide of interview and the students' respond questionnaire. Furthermore, the test of students' Mathematical creative thinking which focus on Mathematical creative thinking ability are fluency, flexibility, elaboration, and original.

Table
The Technique of Collecting Data, Instrument, and The Subject of The Research

No	The aspect researched	The Technique of Collecting Data	Instrument	The Subject of The Research
1	Validity	Validity questionnaire and discussion with the validator	Validity sheet	Lecturer and teacher
2	Practicality	a. Interview	a. Interview Guide	The students in the small group
		b. Questionnaire	b. Students' practicality questionnaire	The students in the limited group
3	The ability of students' mathematical creative thinking	Test of the students' mathematical creative thinking ability	Questionnaire sheet	The students in the limited group

The data gained is analysed by the descriptive analysis technique. The activity of analysing the data is classfiying of the data based on the variables, and the kind of the respondents, tabulating the data based on the variable from the total of respondents, presenting the data in each of researched variables and doing calculation to answer the formulation of the problem.

1. The analysis of validity and practicality test

To determine the validity and practicality of Math module on metacognitive approach basis, it should be done by some steps:

a. The collected data validity result will be tabulated.
b. Calculate the total score of the questionnaire answers and determine the criteria of score. The amount of the criteria score is that the highest score each item × the amount of items× the amount of respondents.
c. Then, finding of the percentage of the tabulation's result.
d. The validity result of the module will be categorized become:

Table
The Validity Category and Math Modul Practicality on Metacognitive Approach Basis

%	Category
0-20	Unvalid or impractical

21-40	Less valid or practical
41-60	Enough valid or practical
61-80	Valid or practical
81-100	Very valid or practical

Then, the data should be drawn in the descriptive tehnique

2. The analysis of students' Mathematical creative thinking test

The students' Mathematical creative thinking ability in *Barisan and Deret* material is shown by score gained by the students after joining the test. The tabulation score result which is gained by them , then it will be finded the percentage by using the formulation below:

$$S = \frac{R}{N} \times 100\%$$

In which:

S : value hoped

R : the amount score of item or the correct answer

N : the maximum score of the test

Then, the percentage result is categorized based on the general criteria of students' Mathematical creative thinking qualification as follow:

Table
The General qualification Characteristic
of Mathematical Creative Thinking Ability

%	Category
80-100	High
60-79	Moderate
<60	Less

Then, the data should be drawn in the descriptive tehnique

THE RESULT AND DISCUSSION

In the followingwill be discussed about the data processing which is gained from the validity, practicality and the test of creative thinking test.

1. The data of Module validity result
   a. The validity result of learning material expert

   The validity resul by the learning material expert is can be seen based on the following table:

Table
The Result of Validity by The Expert of Learning Material
on Math Module Metacognitive Approach Basis

No	Validity Variable	Indicator	Question Number	Validity Value	Criteria
1	Didactic	The appropriateness of	1,2,3,14	85%	Very valid

	requirements	module with the curriculum and learning indicator			
		The emphasizing on mathematical creative thinking	4,15	80%	Valid
		The competence attainment on exercising questions	6,7,27	80%	Valid
2	Construction requirements	The usage of language which is appropriate with the degree of students' progress	21, 22, 23	83,33%	Very valid
		The presentation of material should be clear, and simple. It is also have a title and detailed material	8, 9, 10, 11	90%	Very valid
		Providing of specific room for writing or drawing something on the module	12	90%	Very valid
		The module completeness	26	80%	Valid
		The clear and beneficial goal	13, 20	90%	Very valid
3	Metacognitive approach requirements	Every material in the module is dominated by metacognitive questions	16, 17	80%	Valid
		Providing the specific boxes of conscience expressing or students' assessment	5	100%	Very valid
		The questions provided are stimulated students' metacognitive	18, 19	90%	Very valid
		Instruct the students to be more active and creative in learning	24	90%	Very valid
		The correlation of the topics provided	25	90%	Very valid
Mean				**85,93%**	**Very valid**

Based on the table above, it is clear that the total percentage of assessment by two of learning material experts is very valid, 85,93% because it is in the 80%-100% interval, so that the Math module is not need a heavy revision. Yet, the comment and suggestion from the learning material expert can be an improvement to perfect the Math module better.

b. The validity result of education technology expert

The validity result of education technology expert is can be seen based on the following table:

Table
The Validity Result of Education Technology Expert on Math Module Based Metacognitive Approach

No	Indicator	Question Number	Validity Value	Criteria
1	The letter usage and the writing on module	2, 4, 5, 9, 10, 11, 12	80%	Valid
2	The design module	1, 3, 7, 8, 13	78%	Valid
3	The picture usage	6, 15, 16	86,67%	Very valid
4	The module performance	14, 17, 18	86,67%	Very valid
Mean			**81,67%**	**Very valid**

Based on the table calculation above, it is clear that the total percentage of assessment by two education technology experts is very valid with the percentage 81,67% because it is in the 80%-100% interval so that the Math module not need the hard revision. Yet, the comment and suggestion from the education technology expert can be an improvement to complete the Math module better.

c. The total data (learning material and education technology expert)

The total data of learning material and education technology expert was gained then, it amounted and divided become two like in the following table:

Table
The Total Data CalculationResult of Validity Test

No	Module validator	The ideality Percentage
1	Education technology expert	85,93%
2	Learning material expert	81,67%
Mean		**83,8% Very valid**

Based on the calculation above, it is gained that the validity degree of Math module that has developed is 83,8%. Meaning that, this Math module is categorized in very valid category because it is in the 80%-100% interval, so that the module is qualified to tested to the students. Yet, comment and suggestion from the experts can be an improvement to complet the module more better.

2. The data of module practicality try out test
   a. The try out of the small group

This try out in the small group include the students about 6-12 respondents. It is important to be done to anticipate as long as the applying conducted. Beside that, this try out also beneficial for analysing the obstacles involved and reducing the obstacles in the next stages. This try out is for knowing whether the learning material that is developed still has the mistakes or lack and asking the suggestion for improving based on the mistakes found by the students. This try out is done to sixs of students by using the interview. Theinterview result of the students in this small group is gained some suggestions and comment, like as follow:

Table
The students' Suggestion on Math Module based Metacognitive Approach

No	The suggestion and comment	Improvement
1	Additional conclusion/material summary	Improved
2	The mistake on the answer key in the second exercise, at 2^{nd} number and the error in finishing the example in 18^{th} page	Improved
3	The additional formulation for*Deret*, is that $U_{n=S_{n}-}S_{n-}1$	Improved
4	Improve the illustration for material geometry line	Improved

b. The try out of the limited group

In the end of the learning in the classroom, it is done practicality for knowing whether the modul which is developed had practical or not to be used for the students in the learning. The assessment result of practicality in the try out, it will be described in this following table:

Table
The practicality Test percentage in the limited group

No	Indicator	Practicality Value	Criteria
1	Students' interest and module performance	84%	Very valid
2	The usage of module	80%	Very valid
3	Metacognitive approach and mathematical creative thingking	79,58%	Practical
4	The usage of time	77%	Practical
5	The evaluation	85%	Very practical
Mean		**81,71%**	**Very practical**

Based on the calculation above, it is clear that the total percentage of students' assessment in the try out of limited group is 81,71%. It means that the modul is very practical for the students because it is in the 80%-100% interval so that the Math module is not need the revision. Yet, suggestion and comment from the students can be used as the consideration in completing this module.

3. The data result of students' mathematical creative thinking test after using the module

   This test is done for knowing the degree of students' mathematical creative thinking after using the Math module on metacognitive approach basis. This following is the data of students' mathematical creative thinking result afer using the module:

Table
The test result of Students' Mathematical Creative Thinking

No	The indicator of mathematical creative Thinking ability	percentage	Category
1	Fluency	77,5	Moderate
2	Graciousness	82,5	High
3	Detailing	80,63	High
4	Originality	83,75	High
Mean		**81,09**	**High**

   Based on the calculation above, it is clear that the mean of the students' mathematical creative thinking test is 81,09%. Meaning that, the degree of students' mathematical creative thinking had reached high category, because it is in the 80%-100% interval. It is also means that the developed module has facilitated the students' mathematical creative thinking.

CONCLUSION AND SUGGESTION

Based on the result of the research explained above in the previous chapters, it can be concluded that this research had produced the learning material in the form of Math module on metacognitive approach basis in the *Barisan and Deret* material. It is very valid, and practical. It is also found that the students' Mathematical creative thinking ability is high. Meaning that, the formulation of the problem had been answered by the researcher as follows:

1. The validity degree of Math module on metacognitive approch basis is used for facilitating the students' Mathematical creative thinking is very valid in the percentage 83,8%.
2. The practicality degree of Math module on metacognitive approach basis is used for facilitating of the students' Mathematical creative thinking is very practical in the percentage 81,71%.
3. Thestudents' mathematical creative thinking degree after using Math module on metacognitive approach basis is high in the percentage 81,09%.

Based on the research had be done, the researcher sugggests some things as follow:

1. Suggestion for utilization
   a. The researcher suggests that this Math module should be used in learning *Barisan and Deret* material for the eleventh grade in the even semester because it has teted and produced the good result.

b. The usage of Math module on metacognitive approach basis is collaborated with another interesting topic of Math learning so that the learning become more varied, like using cooperative learning, the power of two, etc.

2. Suggestion for developing the product
   a. This Math module on metacognitive approach basis is developed later by doing experiment and using comparasion class so that the quality of Math module authentically tested in the application.
   b. The researcher suggests to the next researchers to develop the Math module on metacognitive approach basis in the same or different material and correlated with the critical thinking ability in order that this module can be used as the learning material in the teaching and learning process.

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THE ANALYSIS DESCRIPTION OF REQUIREMENT BASED ON WEBSITE MATERIALS DEVELOPMENT IN ANALYTIC GEOMETRY CLASS

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Abstract

The development of science and technology which develope has an impact on education. This case seen when lecturer give material of analytic geometry subject, students not only need the guidance of lecturers directly or face to face, but they also need guidance beyond the lecture activity. Therefore do a research with the aim of analyzing the students necessary in the lecture of analytic geometry that connected with the design of the web-based teaching materials. This research method is descriptive qualitative research instrument in the form of sheets of observation and interviews. The Subjects were students who took an analytical geometry lesson in STKIP PGRI West Sumatra.The Conclusion of the needs analysis undertaken are: 1. The student is constrained in overcoming difficulties when it faces obstacles in understanding the concept and complete the task, 2. The opportunities for discussions between students and their lecturer outside the lecture time are very limited and 3. Usage of website that available is not been utilized to support the lecture process.

Keywords: Requirement Analysis, Materials, Website, Analytic Geometry.

INTRODUCTION

Information Technology (IT) currently has an important role in the implementation of the course. The existence of IT tools and techniques in the implementation of the course has been empirically proven to be facilitating the company needed to improve the student learning process and result. Lectures can be done by integrating IT in the lecture. This effort is done so that the lecture can provide deep meaningfulness, and achieve the maximum. One of the subjects that require critical role of IT to improve learning outcomes is the analytic geometry.

Analytic Geometry is one subject of the Scientific and Skills (MKK) that must be learned by the students in Mathematics Education STKIP PGRI West Sumatra. Analytical Geometry courses weighs 3 credits. Analytical Geometry courses is one of the subjects is a precondition for other subjects, such as the many variables calculus and vector analysis. Lecture materials on Analytical Geometry course covers the theory of analytic geometry and analytic geometry of space field.

Subject Geometry Analytical discusses coordinate system (in the field and in the room), the distance between two points on the field and in space, equation of a line in the field and in space, equation planar, circular and sphere, parabola, ellipse, hyperbole, cylinders and cone ball sheath. To be able to master these competencies, students are facilitated with face to face lectures and textbooks that are relevant to the course. The fact that happened, there are still many students who receive low marks. Based on interviews conducted on January 19, 2015 in West Sumatra PGRI STKIP with some students, it is known that the students difficulties in understanding the material contained in the textbook. Language textbook Analytic Geometry still not communicative and interactive for students STKIP PGRI West Sumatra so as to understand the material students are only waiting for an explanation from the lecturer. This could definitely hinder the creation of an atmosphere conducive lecture. Another issue that students expressed that students are constrained in overcoming difficulties when it faces obstacles in understanding the concept. Opportunities exist for discussions between students and professors outside lecture hours are very limited. This resulted in students just waiting for the opportunity to discuss with the lecturer during lectures to-face. Based on the problems that have been presented, so that students can achieve the expected competencies will require a teaching materials that can facilitate students to understand the concepts and be able to give students the opportunity to hold discussions with the lecturer. Teaching materials developed using web-based learning media can be one of the best solutions. Along with the development of Information and Communication Technology (ICT) is growing rapidly, the need for a concept and mechanism of learning (education) by utilizing the technology becomes inevitable. Analytical Geometry lecture using a web-based instructional media provide a new experience for the students. Lectures that had been done in the classroom to switch to the computer laboratory. This of course can create a different atmosphere in lectures Analytical Geometry.

In addition, media-based learning website provides the opportunity for students to independently learn and open up opportunities for students to discuss with the lecturers at the discussion forum provided. Media-based learning website can facilitate students to learn outside of lecture hours because there are media teaching materials that facilitate students to understand the concept. One form of web-based learning media can be applied to the lecture is e-learning. The concept was then known as e-learning bring the influence of conventional education transformation process into digital form, both contents (contents) and the system.

Currently e-learning concept has been widely accepted by the world community, as evidenced by the widespread implementation of e-learning, especially in educational institutions (schools, training and university). Some colleges conducting electronic learning as a supplement (s) of the subject matter presented in class on a regular basis (Wildavsky, 2001; Lewis, 2002). However, several other universities conducting e-learning as an alternative for students who for one reason or another unable to take the classes in person. In this regard, e-learning to function as an option (option) for students. Teaching materials and interactive communicative and can facilitate students to discuss interests and independence can bring students to be able to understand the concept well. Therefore, based on the above background, developed a teaching materials Analytic Geometry based websites.

RESEARCH METHODS

This research method is descriptive qualitative. This study focused on the analysis of the needs of students in the lecture analytic geometry that will be used as the basis for the development of teaching materials to support the analytic geometry lectures in STKIP PGRI West Sumatra. Research conducted at the Education Studies Program math STKIP PGRI West Sumatra. The subject of research is a lecturer of analytic geometry by the number of lecturers as much as 2 people and students who take courses STKIP PGRI analytic geometry in West Sumatra.

The object of this study is the strategy used in the lecture lecturer, conditions and resources to support lectures analytic geometry, constraints and obstacles encountered in implementing the course lecturer. The instrument used to collect data in this study is the observation sheet and interview guidelines. Observation sheet used to obtain information about the strategies used lecturer in the lecture and to get an idea of the constraints and obstacles encountered in the process perkulihan, while the interview guides used to obtain more complete information about the conditions and the carrying capacity of the lecture analytical geometry as well as get an overview of constraints and obstacles faced in the lecture.

Needs analysis activities performed to get a picture of the condition that occurs when the lectures Analytical Geometry. In this activity steps are as follows:
1) Conducting interviews with students and colleagues. Interviews with students and

colleagues aimed to find out the problems / obstacles are encountered in the field in connection with Analytic Geometry lecture. Problem / obstacle may come from students and lecturers who teach Analytical Geometry.

2) Analyze Syllabus

It aims to determine whether the material taught is in conformity with the expected competencies. In addition, also see the lecture activities that have been planned, whether the facilities are teacher centered or student centered.

3) Analyze and reference books mereviuw algebraic structure It aims to look at the contents of the book, manner of presentation, practice questions and tasks, whether it is in accordance with the course syllabus is valid.

4) Analyze Student Characteristics Student characteristics need to be the basis for the development of teaching materials based website Analytic Geometry. It aims to facilitate in developing a web-based teaching materials both in terms of language in teaching materials and lurch about.

RESULTS AND DISCUSSION

This phase is carried out to see the picture of conditions in the field related to the lecture Analytical Geometry in STKIP PGRI West Sumatra. At this stage, such measures syllabus analysis, analysis of textbooks, literature analysis, analysis of the characteristics of students and interviews with colleagues. The results obtained in the respective steps are as follows.

1) The results of the interview

Interviews from students and faculty are students difficulties in analyzing problems in textbooks. Students are less independent in the lecture. This led Students' activity is limited to activities recorded, listened to the lecturers and doing exercises. This has an impact on student learning outcomes. Student results did not reach the target because students are often misunderstood and mengaplikan concept. One reason is the concept of mastery of prerequisite subjects. In addition, students who have difficulty in lectures have limited opportunity.

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Based on the problems found in the lecture then designed a teaching materials that can maximize student understanding of concepts and facilitate students to consult with the lecturer. Therefore, in accordance with the teaching materials is a problem of teaching materials using information technology in the form of a web. 2) Analysis Syllabus At this stage, an analysis of the syllabus for the course Analytical Geometry Mathematics Education STKIP PGRI West Sumatra. Syllabus analysis performed to see if the material being taught is in conformity with the expected competencies. There are 12 subject matter to be studied for one semester. These materials are (1) Cartesian coordinate system, the vector field, drawing point, determine the distance between two points; (2) Numbers directions, Cosine Directions, coefficient Directions, Determining the coordinates of points on the line segment pad areas, formulate the equation in the field; (3) forms a circle equation, the equation tangent to the circle, the circle beam; (4) The equation of conic sections, parabolic equations; (5) Equation Ellipse, ellipse tangent to the hyperbolic equations, (6) Equation ball, the relationship between the ball and the field average; (7) The translations coordinate system, rotation, and rotation tanslasi composition; (8) polar coordinate system; (9) The coordinate system space and vector space; (10) Equation flat field (vektoris, linear, normal), the fields are parallel, the fields are perpendicular; (11) Distance to point to the field, the distance between the two fields, the angle between the two fields, the file field; (12) Numbers line direction, the direction cosine line, bentu-form line equation, parameter equation field, as the line of intersection of two flat areas.

2) Analysis Textbook

Analysis of textbooks that do aim to see whether the contents of the book are in accordance with competency in the syllabus. Textbooks analyzed are textbooks that have been used in lectures Analytical Geometry, namely books Suryadi D.H.S. (1986) Analytical Measurement Science Space. Publisher Ghalia Indonesia and book Drs. Rawuh R., et al (1972) Analytical Measurement Science vol 1 dan2, Publisher Ternate Bandung. Based on the analysis that has been done shows that the Analytical Geometry lecture material that is in the text book is not structured according to the existing curriculum. All materials will be taught presented in this text. However, not all the material in the textbooks taught in this course. Irregularities presentation of the material in the textbook causes the material to be disrupted continuity. This could definitely hinder the creation of a conducive lecture. In addition, the presentation of the material difficult to be understood by students. Presentation material is not able to engage students in inventing the troubleshooting steps in order to build understanding of the concept. Based on the analysis described, the development of teaching materials is done with reference to the existing syllabus. Presentation of teaching materials designed so that it can facilitate students to independently find the steps to resolve the issues contained in the lecture material learned.

3) Analysis of Literature

Event analyze literature is an activity undertaken to collect material related to the design of teaching materials. From the analysis that has been made known that the computer-based learning books bouquet Rusman used as a guide in making teaching materials. Teaching materials that will be created are designed using the web. In this rusman book,

4) Analysis of Student Characteristics

Observation done 3 times observation. Observations made on Tuesday, October 27, 2015, on Tuesday November 17, 2015 and Tuesday, December 15, 2015. Observations made on two classes of sessions 2014 A and 2014 B. The first class consisted of 36 people and a second class consists of 38 people. Analytic Geometry in lectures, instructional media used in the form of drawing tools and power point. The learning media lacking maximize the student's knowledge because the media does not involve students in understanding the concept. Other media such as textbooks become a major source of learning for students. Understanding the concept of students to the lecture material Analytical Geometry is still lacking. Underprivileged students in analyzing problems independently. The problems vary from the examples given are not able to be completed by the student. This shows that students do not understand the concept well.

Constraints lecturers in teaching comes from a variety of factors. The first factor is the attitude of the students. Students less diligent in finding a resolution. If you encounter difficulty, the students often give up and wait for an explanation from the lecturer. Facilities for forums between faculty and students outside of the classroom to-face meetings are not yet available. Not all students are given the opportunity to discuss with professors outside of face to face meetings. This happens because of the limited time lecturers and students.

Based on the problems found in the lecture then designed a teaching materials that can maximize student understanding of concepts and facilitate students to consult with the lecturer. Therefore, in accordance with the teaching materials is a problem of teaching materials using information technology in the form of a web.

CONCLUSION

Web-based teaching materials are designed based on the needs analysis that helped lecturer in lectures and students are able to understand the concept well and able to facilitate students to discuss with faculty outside of face to face meetings.

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THE DEVELOPMENT OF LEARNING DEVICE ON THE SOCIAL ARITHMETIC TOPIC THROUGH SOFT SKILLS-BASED METACOGNITIVE LEARNING

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Abstract

Curriculum 2013 demands teacher to plan the lesson, administer learning process and assess the process of learning. The facts show that teachers still get difficulties in setting mathematics learning device accurately and comprehensively. Therefore, this research conduct the development of learning device on the social arithmetics topic at VII grade through the implementation of soft skills-based metacognitive learning. The Social Arithmetics materials include: cost of goods, selling cost, and buying cost; profit and profit percentage; loss and loss percentage; discount, net, gross and tare; and interest. The developed learning device is in the form of lesson plan (LP) and student worksheet (SW) in accordance with the curriculum 2013. The development begins with analysing the need of two schools which apply curriculum 2013 in academic year 2014/2015 in Pekanbaru, developing the learning device, conducting the limited trials, doing the revision, conducting the field trial and doing the revision. The need analysis is conducted by observing the teacher learning device and learning process implementation. Based on the need analysis, the learning device is developed in eight meetings. The development of device is validated by two validators and then revised based on the suggestion of validators. The revised learning deviced is tested in three small groups which have five members for each group. Learning device is refined again and conducted the trial in a class. From the result of the field, it is administered the completion of the device. This research finds the product of maths learning device on the Social Arithmetics topic at VII grade through the implementation of soft skills-based metacognitive learning.
Key words: learning device, the social arithmetic, soft-skills-based metacognitive learning

INTRODUCTION

Curriculum 2013 develops two kinds of learning process namely direct learning process and indirect learning process. In direct learning process, students develop their knowledge, thinking ability and psychomotor skills through direct interaction with the learning sources. Students are educated by observation activity, asking activity, gathering information, associating or analyzing and communicating what they have found in analysis activity. Direct learning process produces knowledge and direct skills.

Indirect learning process is a process of education during learning process and it happens directly, but it is not designed in specific activities. Indirect learning is related to the development of values and attitudes. Therefore, in the learning process of curriculum 2013, activities happened during learning activity in school and beyond of co-curricular and extracurricular activity arethe learning process to develop moral value and behavior related to attitude. Both of direct and indirect learning occurs integrated and inseparable.

To achieve the quality that has been designed in curriculum, learning activity should use some principle such as: (1) focusing on the students, (2) developing students creativity, (3) creating pleasant and challenging condition, (4) containing value, ethics, aesthetics, logic and kinesthetic, and (5) providing diverse learning experiences through applying various learning strategies and methods, contextual, effective, efficient, and meaningful. Students are supported to find themselves and transform the complex information, check the new information that already exists in their memory and develop it becomes information or skills which suitable with the environment, place and time they live. Curriculum 2013adheres to a basic view that knowledge cannot be moved away from the teacher to the students. Students are the subjects who have ability to find, to process, to construct and to use the knowledge actively.Furthermore, learning should be related to the chance given to the students to construct the knowledge in cognitive process. In order to understand and apply the knowledge, the students need to be supported to solve problems, find everything for themselves and try hard to realize their ideas.

The facts show that teacher cannot prepare the lesson comprehensively start from designing to implementing and assessing as the demands of the curriculum 2013 as mentioned above. Therefore, it is necessary to develop learning device such as lesson plan and student worksheet. Lesson plan is a guide for teachers in implementing a lesson and student worksheet is a learning source for the students in constructing their knowledge.

This research is about the development of learning device in the form of lesson plan and student worksheet on the social arithmetic topic. Social arithmetic is a topic that related to buy and sell and money needed by people in life. The social arithmetic materials will be discussed: the cost of goods, buying cost and selling cost, profit and profit percentage, loss and loss percentage, discount, gross, tare, and net, and interest. These materials are presented in five meetings.

This study is conducted by applying soft-skill based metacognitive learning. Metacognitive learning is a learning which imparts a process how to design, monitor, and evaluate the knowledge to the students. Their knowledge is to be developed into action in solving mathematical problems. There are five phases to be followed, namely (1)initial discussion, (2) individual (3) group discussion, (4) group presentation and (5) reflection and conclusion. In each phase is accompanied by empowering students' soft skills (independent, responsible, curious, hard work, polite, careful, respectful, honestlyand teamwork).

In the beginning, students are faced to contextual problem and teacher asks them some questions to provoke their metacognition awareness. Students are facilitated to be able to declare their thinking process in solving problems given in the form of spoken and written answer and also empower the soft skills such as: being confident in answering the question given by the teacher, communicating effectively, being polite and friendly. Teacher asks the students to discuss the material in the form of question in solving problem individually, they are facilitated to empower the knowledge that they have, design the solution, control the thinking process, and evaluate the activities. To solve the problem, students have to pass some phases (understanding, arranging, finishing the solution design and interpreting the result of problem solving). In this case, soft skills empowered are confidence, responsibility, hard work, logical thinking, critical, individual, and curiosity. Students finish the questions of the problem solving appropriate with the topic discussed in initial discussion individually. Teacher goes around the classroom and gives metacognitive feedback individually that guides the students to correct the mistake by themselves. This situation can empower students' soft skills around confidence, individual, responsibility, politeness and curiosity. Teacher asks students to do reflection on the activities that they have done in initial discussion and stage of individual. In this case, it can empower curiosity and honesty. In the end of the material, if there are some students who do not understand, so they will write their questions on the material and then discuss them in group. In this case, it empowers confidence and honesty.

Teacher asks students to discuss the material that they do not understand in a small group which consists of four to five members. As individual activity to empower their confidence, responsibility, awareness, respect, politeness and team work. Teacher asks the representative group to present their discussion in front of the class so the group discussion will be happened and share each idea. When this activity is happening, the students will be expected to communicate well: talk honestly, use effective and efficient language, relieved and not easy to get anger, have initiative to open the group discussion, use the language well, friendly and polite.

In conclusion phase, students write, gather, and conclude it by themselves. All of the activities that have done during learning activity while the teacher also gathers the conclusion and guides the students by giving them metacognitive questions to help them make reflection on the process and the outcome that they get. This stage will empower their soft skills such as: confidence, curiosity, respect, politeness and individual. In the last stage, teacher gives homework and asks the students to write a journal about their experience description while following math subject. This activity can empower their soft skills about confidence and honesty.

RESEARCH METHODOLOGY

The development model used is based on the model by Borg & Gall with some steps. For example (1) needs analysis, (2) learning device development, (3) validation of device, (4) revision of validation result, (5) limited trials, (6) revision of trials result, (7) field trials, (8) revision of field trials result. This development produced learning device product such as lesson plan and student worksheet for the social arithmetic topic at VII grade students.

The activity steps in needs analysis are curriculum and learning material analysis, looking at the learning device used by the teacher and observing the implementation of learning material. From the needs analysis result designed the learning device in the form of lesson plan and student worksheet through soft skill – based metacognitive learning on the social arithmetic topic for five meetings. All of the learning device are validated by two validators whose qualification as an expert mathematic education. The revised validation result will be tested on the three groups of students who will learn about the social arithmetic topic as limited trials. After that, it will be revised and the revised device will be tested on the group of students in a class. The result of this field trials is revised again to get the desired product.

The development of lesson plan has some components: subject identity, core competences, basic competences, indicators of competence achievement, learning objectives, learning material description, learning method, media, tools, and learning sources, learning activities, and assessment. Students' worksheet has some components such as: title, discourse, activity and practice.

The limited and field trials are conducted in SMP Babbusalam Pekanbaru. The limited trials are implemented on three groups of VII_1 grade students which each group has five members. Meanwhile, the field trials are implemented on the VII_2grade students with the number of the students is 25 students. The data collection is qualitative and quantitative data. Qualitative data are the description of the learning implementation by using the designed device while quantitative data are collected from the questionnaire that is completed by the students and the teacher about the use of student worksheet. The analysis data is conducted by using qualitative and quantitative. The tested device is revised to get the desired product.

RESEARCH FINDING AND DISCUSSION

The needs analysis shows that teacher ability in designing and making the lesson plan is still low. It still does not refer to the Permendikbud rules. The description of the lesson plan made by the teacher is as below:

1. The components of the lesson plan are not complete yet and the content of each component is not appropriate with the competences required of the students.
2. The indicators formulation and the learning objectives are less operational and do not follow the rules.
3. Each lesson plan does not show the planning of the implementation learning which is appropriate with the learning material characteristics.
4. The learning material description is not detail. It shows that the teacher does not analyze the learning material appropriately and often find the teacher just write the title of the learning material.
5. The learning method (model and approach) is not clear, therefore, the steps of the learning activities are incomplete, inaccurate and not systematically.
6. The media used are not designed appropriately.
7. Effective, cognitive and psychomotor assessment is not accurate and comprehensive.
8. The manufacture of the lesson plan is only to fulfill the school administration and do not refer to the clear concept and purpose.

The analysis of the lesson plan and the student worksheet prepared by the teacher are also analyzed as a source for the students. In general, the teacher does not prepare the student worksheet well. The students do an activity based on the teacher's instruction and commands. Therefore, the students do not have chance to construct their knowledge.

The result of the development of lesson plan and student worksheet for five meetings is continued to validation process. Validator's comments state that phases of soft skill – based metacognitive learning model on lesson plan need to be described clearly, so it can be guide for the teacher in implementing the lesson. It will be the same as student worksheet and the students' activities in each phase are designed operationally.

Lesson plan and student worksheet are repaired based on the validator's comments, then do the limited trials to the three groups of students which five students in one group. The result of the limited trials shows that the lesson plan needs to be considered in using time efficiently and the sentences used in the student worksheet need to be simplified, so the students can understand it easily and they can construct their knowledge. Lesson plan and student worksheet which have been tested on limited basis need to be refined and continued to do the field limited trials.

The result of the field limited trials shows that teacher can implement the learning based on the scenario in lesson plan. The activities are designed on the student worksheet can emerge the students' metacognitive process.

Soft skill – based metacognitive learning is implemented by creating students' awareness how to design, monitor, and evaluate the thinking process and activity in problem solving by empowering or internalization of soft skill such as confidence, hard work, curiosity, honesty, individual**,** politeness, respect, and team work (Yoomg, 2002; Biryukov, 2003; Tan, 2004; Mohammed, 2005; Lioe, et al 2006; Prastiwi, 2011). These activities can make the students feel happy and comfortable to follow the lesson such as the teacher and students' comments while interviewing. Teacher said the students became enthusiastic in learning independent and used to finish the questions of problem solving. Likewise, the students said that they were happy in learning although the questions were challenging their thinking process.

The learning implementation should be effective by giving chance to the students to develop their knowledge and apply what they have learned. The students should develop their ideas and skills in the new situation. Furthermore, they also should be able to develop and apply attitude/value they get in daily life. Learning fun can determine whether the quantity and quality in learning is continuously or not. For the students, learning fun is created because the students are involved intellectually and emotionally. The students know how important and challenging the lesson, to get the friendly situation and have chance in making decision. The students are in a brief situation in acting, asking, giving opinion and asking others' opinion. The students construct their knowledge by involving on the process and thinking activity.

In initial discussion phase, the teacher asks the students to do the learning materials individually for examples, "gross, tare and net" materials through student worksheet which has a picture of a pack of Chitattos that they like. The students are asked to look at the net in that picture. Moreover, the students are sought a picture of a pack of Chitattos in front of the class to make them focus on the discussion material. By means of this media, the students are guided with metacognitive questions to find the definition and the formula of gross, tare, and net. The students are facilitated to gain their knowledge, to control the thinking process and to evaluate the activities. The students are asked to solve the problem and the worksheet given by the teacher accurately. When the teacher facilitated the students, there is a teacher and student dialogue happened. The teacher can empower students' soft skills about communicating with the teacher, curiosity, individual, responsibility, and confidence. Next, the students are given a problem and they must use the formula they got. The students are facilitated to gain their knowledge, to control the thinking process and to evaluate the activities done.

In individual phase, the students finish the questions about problem solving in the student worksheet with the appropriate topic which has discussed in initial discussion individually. The teacher goes around the classroom and gives metacognitive feedback individually and guides them to correct their mistakes individually. This situation can empower students' soft skills such as confidence, independence, politeness, hard work and curiosity. And then, the students are asked to do a reflection about the activities in initial discussion and individual phase. The students should write what they do not understand to be discussed in group. The soft skills empowered are confidence and honesty.

The next activity, the students discuss in a small group which is heterogenic and has 4-5 members to discuss about the materials which have been discussed individually in the first and the second phase. During discussion, the students are trained to be confidence, politeness, awareness, responsibility, and teamwork. The teacher facilitates and guides students to overcome the students' difficulties in solving the problem to get the correct solution.

After group discussion, the representative group is requested to present their discussion and the other groups give responses. Teacher asks the representative group to present their discussion in front of the class, so that each group can share the idea. The other groups are requested to ask question, give responses and give ideas. In this chance, the soft skills are empowered such as confidence, responsibility, hard work, independence, respect and politeness. During this activity, the students should be able to communicate well by using effective, efficient, friendly, and polite language.

In conclusion phase, the students write conclusion about all of the activities during the learning activity takes place. Meanwhile, the teacher gathers the conclusion and guides the students by giving them metacognitive questions such as "What have you learned today?, and What is your impression in finishing the problems/questions given?". Those questions guide the students to do reflections on the process and the result they got.

From the implementing of that learning can be seen that if the teacher asks more metacognitive questions, the students' activities in finishing the task given are more increased. It is happened because the students face difficulties in doing task in the student worksheet. Therefore, if the teacher facilitates the students by giving questions to gain their knowledge, so their difficulties can be solved and they can continue their work. It means the students can associate their knowledge with the new knowledge that is being discussed. This learning activity is related to the important of the metacognitive attitude development through giving metacognitive questions to the students such as Costay (2011) states that by giving question in learning process, the students' metacognitive attitude can grow and thrive.

CONCLUSION

This research finds learning device in the form of lesson plan and student worksheet on the social arithmetic topic for VII grade students in five meetings involved: profit and profit percentage, loss and loss percentage, discount, gross, tare, and net and interest.

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DESIGN RESEARCH USING PMRI APPROACH AND INQUIRY MODEL ON THE SUBJECT OF CIRCLE AT CLASS VIII IN SMP ST. KRISTOFORUS I JAKARTA

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Abstract

Circles are part of a geometry that requires abstraction capability, visual and spatial abilities of students so that needs to be introduced through the form and a real problem. But the learning activities nowadays provides less and less realistic context and opportunities for learners to conduct an investigation. The test results of students of SMP St. Kristoforus I Jakarta shows low learning outcomes in the geometry of the material, and in particular the topic of circles. The purpose of this research is to develop local learning theory with the approach of Pendidikan Matematika Realistik Indonesia (PMRI) and inquiry learning model on the subject of the circle. This study uses research design consists of three phases: preparation and design, implementation of learning and retrospective analysis. Context used is the game looking for secret objects, objects of a circle and reallotment. A retrospective analysis showed that PMRI approach and inquiry learning model can develop students' ability to solve real problems associated with the circle, students are able to elaborate the real problem with math concepts and communicate ideas and those ideas orally and in writing.

Keywords: PMRI, design research, inquiry, circle

INTRODUCTION

Geometry is an abstract representation of visual and spatial experience such as fields, patterns, measurement, and mapping. Geometry is the science interesting and important study because the forms are studied in geometry are the forms that surround us, it is important for the geometry is the basis of the various branches of science such as art, biology, physics, and the solar system. Awareness of the importance of geometry has not, in fact, have an impact on learning outcomes. The test results for the material geometry even lower than the other materials. Students are often confused with geometry problems associated with everyday life. Students unusual exposed to realistic problems in mathematics and less able to resolve the problem given. The results of the initial tests were given to students of SMP St. Kristoforus I shows that the ability of the students in the elaboration of mathematical concepts, especially the concept of geometry and measurement with real problems are still very low. It can be caused by internal problems like any externally. One of the factors outside the student is learning design applied in the classroom. Based on the above, the research conducted design research: Using Pendidikan Matematika Realistik Indonesia (PMRI) approach and Inquiry Model on the Subject of Circle at Class VIII in SMP St. Kristoforus I Jakarta. The question in this research is: "How to design learning and inquiry model PMRI approach to the subject of the circle at class VIII in SMP St. Kristoforus I Jakarta?" This study aims to determine how to design instructional design using PMRI approach and inquiry-based learning on the subject of the circle.

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THEORETICAL FRAMEWORK

1. Pendidikan Matematika Realistik Indonesia

Circle at class VIII in SMP St. Kristoforus I Jakarta can develop the student's understanding about Pendidikan Matematika Realistik Indonesia (PMRI) refers to the approach of Realistic Mathematics Education (RME) developed by Freudenthal. According to Freudenthal, RME developed based on the interpretation that mathematics is a human activity (as cited in Gravemeijer,1994). Activities may include activities intended to solve the problem, looking for problems and organize course materials. Problems can come from real life who then organized according to mathematical patterns or problems of mathematics itself, both old and new problems, which is organized by the new ideas to be understood in a broader context. This organized activity called mathematically.

Freudenthal states that mathematics must be rediscovered (reinvention), so it was not given to students as a finished product. In PMRI students do not simply accept mathematics as study materials that have been organized and the standard to be followed by the students for granted. Mathematics should be studied by students through a context that is close to them. Context is then created in schematic form, a symbol or a model as a process activity to understand the context presented. So in PMRI mathematics activities not only formal mathematics or mathematical activity vertically but also horizontally mathematics. Horizontal mathematization is the process of real life into mathematical symbols while vertical mathematization is the process of mathematical symbols to the symbol.

PMRI approach learning with a more student-centered. The main perpetrators and planners of the learning process are the student's own. Students build a new knowledge of the problem in real life based on their own creativity and own initiative in exploring the concepts that exist. During this process, students collaborate with friends. Teachers act as facilitators, guiding students when needed. When students have difficulty teachers provide assistance without taking over the opportunity for students to build their own knowledge construction.

Treffers (as cited in Gravemeijer, 1994) formulated five PMRI characteristics, namely;

a) Context:
   The development of mathematical concepts in PMRI beginning of a real life context. Context can be a real-world situation, games, models, meaningful situations, imaginable things.
b) Developing Progressive Mathematics
   Progressive mathematical models to serve as a link between the context and the concrete situation into a more formal mathematics through mathematical processes (Gravemeijer, 1994). The mathematical process of translating a concept into a mathematical context.
   According to Gravemeijer there are four levels in the process of developing a model:
   1) Situational Level:
      At this level, the model developed by the students themselves in accordance with the given contextual problem
   2) Referential Level:
      At this level, students create a model of the situation that is described in the context. Models created called the "model of" situation. Model of is a generalization and formalization of the model situation.

3) General level
At this level, students seeking solutions used mathematical context. Models at this level are called the model of is for the settlement of the problem.
4) Formal level
At this level, students begin work using symbols and mathematical representations. Furthermore, at this stage the model for developing a formal mathematical model.

c) Use of Student's Construction Results
Students should be able to construct problem-solving strategies by themselves with teacher's facilitation. The results of the student's construction can further be used for the development of basic mathematical concepts.
d) Interactivity
The interaction between teachers and students and among students can develop the skills of students, not just the cognitive abilities, but also affective abilities of students.
e) Intertwining
Through the intertwining with other fields of concepts and the student is expected to build a mathematical concept as a whole.

2. Inquiry-Based Learning

Gulo (2008) (as cited in Anam, 2015) stated inquiry as a series of learning activities which involving all students' abilities to find and investigate systematically, critically, logically, and analytically so that they can formulate its own discovery with their self-confidence. Meanwhile, according to Khan (2005) Inquiry- Based Learning (IBL) is an approach to learning that is driven by the investigation. Teachers define tasks and facilitate the learning process, but students determine their own direction of the investigation, using prior knowledge and identify learning needs. Students looking for evidence to support their ideas and be responsible for analyzing and presenting the results of the investigation, either individually or in groups.

According to Anam (2015, pp.15-16) inquiry learning has advantages as follows:

a) Real Life Skill: students learn real world skill, about important yet easy to do things.
b) Open-ended Topic: students will learn more, because the theme is studied is not limited to textbooks, but it could be from anywhere; the student experience, the Internet, television and so on.
c) Intuitive, Imaginative and Innovative: students exert all potentials they possess, from creativity to the imagination.
d) Opportunities to Make Discovery: students have the chance to make discovery through observations and experiments.

According to Suchman (as cited in Gunter, 2010) inquiry-based learning can enhance students' thinking skills. Students can be trained to perform a variety of procedures in inquiry learning so that students can learn to engage in the process to find something. Suchman found there are 7 steps that need to be done in inquiry learning, namely; 1) select the problem and planned investigation,
2) introducing process and presents a problem, 3) collect data, 4) develop and verify the theory,

5) explains the theory and stated the rules relating to the theory, 6) to analyze the process and
7) evaluate. Meanwhile, Eggen and Kauckak found in inquiry learning are stages as follows:

1) presents a question or problem, 2) make a hypothesis, 3) designing experiments, 4) conducted an experiment to gather information, 5) collecting and analyzing data, 6) make a conclusion.

Based on the view of the inquiry learning above, it can be summarized that the inquiry is a model of student-centered learning, which starts from a statement or major question that should be completed by the student anyway. In the process of discovery of answers to a given problem, students undertake an investigation by discussing. This study uses a model of inquiry learning stages as follows:

1) Problem from Student's Experiences
   At this stage, the student will be confronted by the problems that arise from real experience he endured. Teachers explore the experience of students through a question and answer activity or with the help of media. The purpose of this phase is to enable students to understand the problems that exist and have the motivation to get it done.
2) Prediction
   At this stage, the student to analyze the existing problems and then discuss how the problem can be resolved and how its completion.
3) Planning
   At this stage, the students plan what is needed, what to do and how to do to resolve the problem.
4) Investigation
   At this stage, the students conduct the investigation by conducting various activities; experiments, discussions, observations and literature review. The investigation is recorded in the form of text, tables charts, or video.
5) Sharing
   At this stage, the students presented the results of their investigation to another friend.
6) Reflection
   At this stage, the students reflect all learning activities. It is intended that students learn more about themselves and in continuing to improve the way and learning results.
7) Interpretation and Conclusion
   At this stage the student to analyze the gathered data and made conclusions in response to questions that appear at the beginning of activities.

Judging from PMRI characteristic and inquiry learning model, it can be seen that the inquiry learning is closely related to Pendidikan Matematika Realistik Indonesia (PMRI). Issues raised from the beginning of the real problem which is close to everyday life, real problems in student life. Furthermore, students develop inquiry until they find knowledge, which is the equivalent PMRI with activities to develop a model of situational models and later became a model of a model for. Event discussions also support interactivity between students and teachers.

3. Learning Circles

The circle is one of the materials included in the field of geometry and measurement. Geometry is derived from the Greek, *Geometrien* that is mean Earth and *metrein* that is mean measurement. Geometry is a geometry and also a branch of mathematics that studies the lines, angles, areas and space as well as the nature, size and relation to one another. Geometry occupies a special position in the mathematics curriculum because a lot of the concepts contained therein. Based on the psychological point of view, the geometry is an abstract representation of visual and spatial experience, eg field, pattern, measurement, and mapping. Meanwhile, from the standpoint of mathematics, geometry presents approaches to solving problems, such as images, diagrams, coordinate systems, and vectors. Circles is an abstract visual form so that the presentation should begin with models of real objects known. by students and in accordance with the level of students' progress. In 2013 the subjects of the mathematics curriculum in class VIII, the circle is one of the materials geometry and measurement. The material is selected in this study only to the calculation of circumference and area of a circle. Students are expected to define the elements and parts of circles and calculate the circumference and area of a circle. This part was fundamental to the material further. Therefore, students should have a good understanding and be able to use that understanding to solve problems in everyday life and use it for the next stage of mathematics.

Elements such as the radius of a circle, arc, arc, chord and earthenware encountered in everyday life. The circle as a geometrical form is widely used both in terms of beauty (art) or in terms of functions (function). For example, a wall clock is often made with a circular shape to make it look more beautiful while the motor of the hour circle in order to function properly. The process of introduction of these elements through real objects that have a shape like elements which are intended to facilitate the students to be able to understand and distinguish them from each other. The right approach is used to instill the concept of traveling is by doing activities around a circle. The learning model used to rediscover the formula circumference of a circle is an inquiry. It is intended for students experiencing learning experience that can make it more creative. Students are invited to experience the process of measuring the circumference and diameter of a circle to find the value of pi, which later became the basis for the invention of the formula circumference of a circle.

Once students understand about the circumference of a circle, the students then investigate how to calculate the area of a circle. By using the knowledge base that has been held on the broad flat wake students designing an investigation into the area of a circle with the context of the real object. Students rebuild knowledge of the construction area of a circle through the activity of changing the shape of the circle into another flat wake. Students are given the freedom to create with fixed to connect with mathematical concepts.

METHOD

This study uses a research methodology design research. According to Bakker (2004), research design is one way to develop an instructional theory. The advantages of the research design are that it can produce an instructional theory that is based on theory and empirical. Bakker further stated that there are three phases of the research design, namely: 1) preparation and design, 2) teaching experiment, and 3) retrospective analysis. The third phase is the connecting hypothesis Learning Tracks (HLB).

After studying various theories from various sources and reviewing instructional theory, HLB prepared. Furthermore, the HLB will be the focus of attention during the learning process and ultimately become a study on a retrospective analysis stage.

More details of the three phases can be described as follows:

1. Preparation and Design

The first activity carried out at this stage is to conduct a study of the problems facing the theory that the study design can be made based on the theory right. Gravemeijer (1994) suggested that the research design is based on the theory and practical experience in teaching. The main objective of this phase is to create a local instructional theory while the concrete form of the theory is hypothetical learning trajectory.

This study was designed with 4 stages of learning. The first stage aims to provide a basic understanding of the circle and the elements contained in the circle. Students work with the context of the game I LKS determine the location of an object within a certain secret of a point. This activity aims to enable students to find the definition of a circle. The same problem then developed to introduce students to parts such as the circle arc, bow, bowstring, and earthenware. The second phase aims to find the value of the pi approach. The first activity at this stage is to recall the concept of the circumference of a circle. Furthermore, teachers lead students to do activities in LKS II. The context in the form of real objects circle handpicked by students and activity measurements were performed by the students can bring students to the concept of the circumference of a circle. How does the measurement process is determined solely by the student? This is in accordance with the characteristics of inquiry learning in which students who determine the direction of activities. Still in the second stage then performed the activity to find and use the formula circumference of a circle. According to the guidelines in Worksheet, III students are expected to determine the formula for the circumference and use it to issue appropriate given the context. Once students understand the concept of the circumference of a circle, the third phase implemented. The third stage aims to find a formula for the area of the circle. The learning model used is such an inquiry; students are asked to reinvent the formula for calculating the area of a circle using reallotment, ie changing the activities of a form into another form with the same area. Students will also link the concepts found earlier that the value of pi approach when building a broad concept. The last stage in this process is to use the concept of the circumference and area to solve open-ended problems with PMRI characteristics.

2. Teaching Experiment

This phase is the full implementation of the theory of the learning process that has been made. At this stage between the theory and the reality of the matter in the learning process observed. Teachers teach in accordance with plans already made. In accordance with the instructional theory that has been made, in this study, the teacher must always consider the enforceability of the learning process in accordance with PMRI approach, the inquiry model. The learning process is recorded through observation notes and recordings. After the learning process, results and records studied with the observer resulting triangulation of data. The reactions of the students and the way of thinking that is reflected in the activities of students assessed in accordance with the hypothesis that has been made. Deviations or things that come up that are not predicted previously used as the basis for further revision of the learning process, because the process of recording, recordings and photographs learning activities need to be done carefully.

3. Retrospective Analysis

In this retrospective analysis stage, HLB already made at the planning stage compared with the actual learning process. The analysis was conducted by examining the record observations made by fellow teachers, video learning, student’s learning outcomes, interviews, student’s reflection and teacher’s reflection. The main focus of attention during the retrospective analysis is associated with characteristic HLB, how the inquiry model works and whether students are progressing in the process of learning, would also in learning outcomes. The results of the analysis are used to further revise the learning process and subsequent research.

RESEARCH SUBJECT

The subjects were students of class VIII C second semester of the 2015/2016 academic year. The research subject is determined prior to the implementation of learning so that observations can be done with more focus, without neglecting the important things that happen to other students. Subjects were selected based on the general ability of students in math and activeness during the learning process.

VALIDITY AND RELIABILITY OF DATA

1. Validity

Qualitative validity according to Gibbs (in Creswell, 2009) is an effort examination of the accuracy of the results of research by applying certain procedures, while reliability qualitative evidence to suggest that the approach used in the study will be consistent when used in different studies. Validity in this study improved with a) the data triangulation; combining information obtained from various sources of data (Creswell, 2012). Data in the form of field notes observers confirmed by the results of the discussion with the observer or interviews with students. b) Creating a rich and dense description of the research results. It is intended that the things that are important nothing are missed so that data becomes more and more realistic. c) Conduct a discussion with the observer. It is intended that the interpretation of existing data be more precise.

2. Reliability

Reliability in research design consisting of internal reliability and external reliability. According to Bakker (2004) with regard to the reliability of internal reliability, the extent to which a reliable research results. It also relates to the level of fairness and the argumentation of statements and conclusions made. While external reliability is that the conclusions of research depend on the research subject and the current state of research, it is not dependent on the researcher. External reliability can be described as trackability (Gravemeijer & Cobb, 2001). This means that research results should be tracked and be reconstructed by the reader because the research has clear procedures, the conceptual framework that can be used and the reasons given in drawing conclusions presented clearly.

RESULTS AND DISCUSSION

Based on the results of field notes, observations and recording of the learning process can be seen that learning and inquiry model PMRI approach requires a longer time. Activities I aimed to find a definition circles and parts of circles planned for one meeting should be held in two sessions. Likewise, the activities to find a formula for the area of the circle. Students take a long time to be able to understand the problem given and lack of confidence in sharing his ideas.

Despite having problems with the organization of time, learning activities with PMRI approach and inquiry model looks can develop better learning situation. Interactivity between student and teacher occur in learning activities. Students who already understand providing assistance to students who do not fully understand how to make models of the problems given. Here are excerpts of the conversation going on in the group that is the subject of research:

SP5: Answers for children C Where the heck?
SP1: Kids C was tasked with finding objects that are less than or equal to 5m, meant as a form of the area. Located between two straight lines drawn from point X to A rock and stone to B.
Which one is A stone?
SP5: This is (pointing to the wrong
point). SP1: Which one is B-stone?
SP5: Is this right? (Pointing to the wrong
point). SP1: Please…see the pictures.
SP5: Oh this one…am I
right?
Sp1: Ok. Draw a line from X to A and from X to B and then give the shading on
the rest. SP5: Oh so.

This is also supported by data from the reflection of students who stated that the learning activities of students can collaborate with groups of friends.

Students can also build their own knowledge construction and define part of a circle formed by their own words. Here are the results of student group discussion of research subjects:

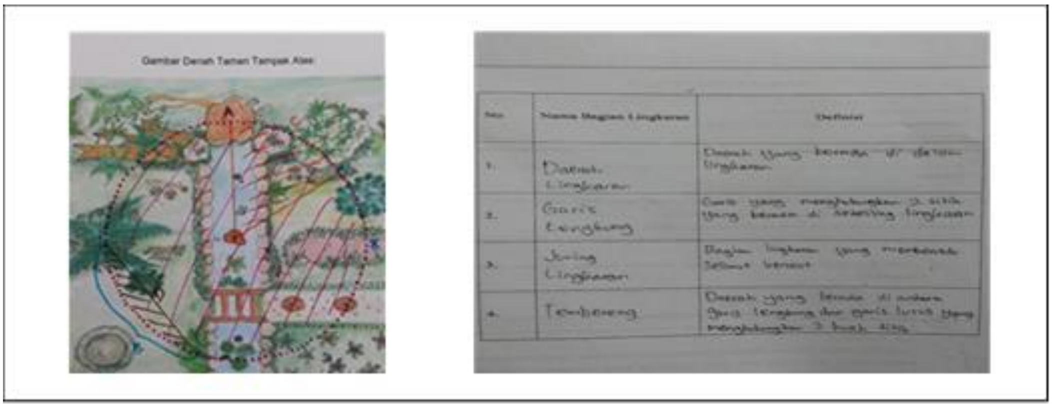

Figure 1 Deliverables Research Subjects

Activities discovered the value of pi to run smoothly and in accordance with what has been planned. Students conduct investigations through measuring the circumference and diameter of circle- shaped objects which they had prepared from home. This activity was conducted based inquiry learning stage is the planning stage. Students are planning what they will object and with what measure and how they measure these objects. Their understanding of the measurement of the activity seen that happen.

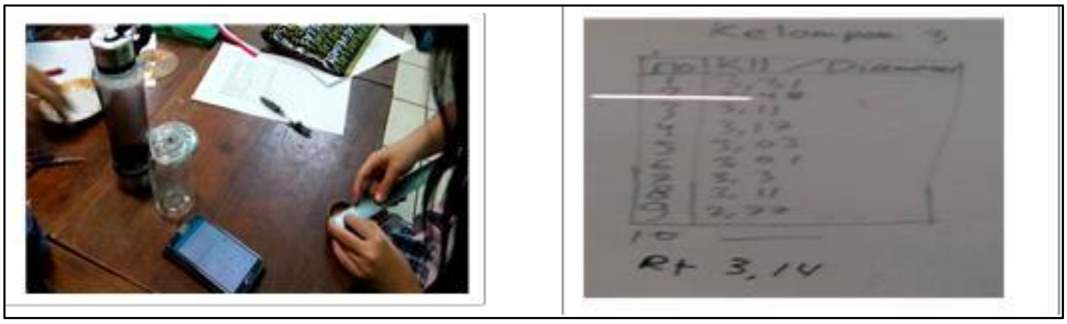

Figure 2 Process and Measurement Results

Students perform measurements using a variety of tools such as tape or twine, and then calculate the ratio of the circumference and diameter of a circle. Tables were made as models of guiding students to the conclusion that the value ratio of circumference and diameter approaching the 3.14 figure they know the value of pi. Furthermore, the model of the developed into a model for the form of the formula circumference of the circle K = πd by utilizing related to the concept of equality.

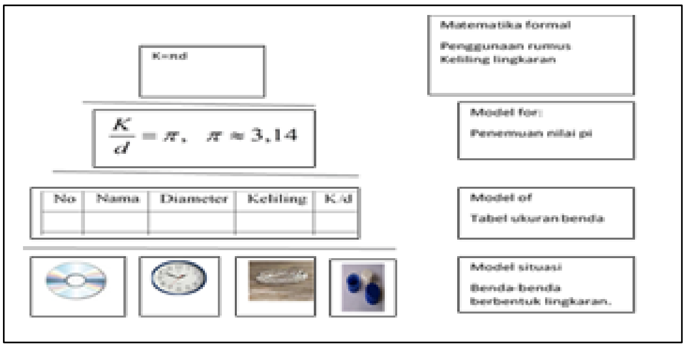

Figure 3 Diagram Ice Berg

Activities found the formula area of a circle goes well with the addition of a record. Activities designed to reallotment context can lead students to find the formula for the area of the circle. Inquiry learning process that provides an opportunity for students to determine the direction of activities make students "forced" to find a way for themselves how the reallotment do. For it still needed the guidance of the teacher as a facilitator. Interactivity does not just happen during the discussion, but also when students present their work and other students provide feedback and input. The results showed that the open-ended question given can test students' understanding of the issues and relate them to concepts already learned.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusion

Based on the results of this study concluded that:
It takes the ability to organize your time well. Teachers should be able to predict the allocation of time required for an activity. In addition to planning, teachers must also be skilled to manage time during the learning process takes place. The planned instructional design should be able to anticipate all possibilities that may occur in the learning process. PMRI instructional design approach and inquiry model can develop students' understanding of the circle.

2. Suggestion
   a) Need further research in order to an instructional design created to further enhance students' higher-order thinking.
   b) Development of teachers needs to be done continuously so that teachers can continue designing and implementing good learning designs.

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CHARACTER EDUCATION DEVELOPMENT MODEL BASED VALUES *TAU JO NAN AMPEK* HIGH SCHOOL LEVEL IN THE CITY BATUSANGKAR

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Abstract

Indonesian state goals as embodied in the Preamble to the Constitution of 1945 is "Advancing the general welfare, educating the nation, and participate in implementing world order based on freedom, lasting peace and social justice". So basically to the intellectual life of the nation is the duty and responsibility of the state. The state should provide educational facilities ranging from budget, educators, learning system, curriculum, and follow-up of the results of the education.In Article 3 of Law No. 20 Year 2003 on National Education System states that "The National Education serves to develop the ability and character development and civilization of the nation's dignity in the context of the intellectual life of the nation, is aimed at developing students' potentials to become a man of faith and devoted to God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become citizens of a democratic and responsible".

Based on the content of these regulations in mind that the true purpose of education is to form man of faith and morality.However, in its application turned out to be the formation of learners dignified, faithful, devoted and noble or affective aspect has not been done properly. The national education system is more dominant to form learners who are intelligent, knowledgeable, skilled, creative, skilled and independent or formation of cognitive and psychomotor aspects. Though these three elements are indispensable and mutually support each other in order to form a whole human beings or human plenary. Even today the education unit in Indonesia raced to produce learners with high intellectual abilities but ignore the quality of emotional and spritual.

Based on the condition that occurs in the world of education, the government re-intensify education in order to build the character of the nation. Implicitly, the government has made the development of the character as one of the priority programs of national development. In a National Long-Term Development Plan (RPJPN) 2005-2025 stated that character education is placed as a foundation for the realization of national development vision, which is "Realizing a society that has high morals, ethics, culture, and based on the philosophy of Pancasila". Local knowledge or local wisdom contains two sense of the word, that wisdom (wisdom) which means wisdom and local (local) which means the local or area of interest. Can be summed up with the ideas of growth and development in a community and be hold by people who are wise, discerning and well worth it. Local knowledge can be regarded as the cultural superiority of a society which has become a matter of life and worn continuously.

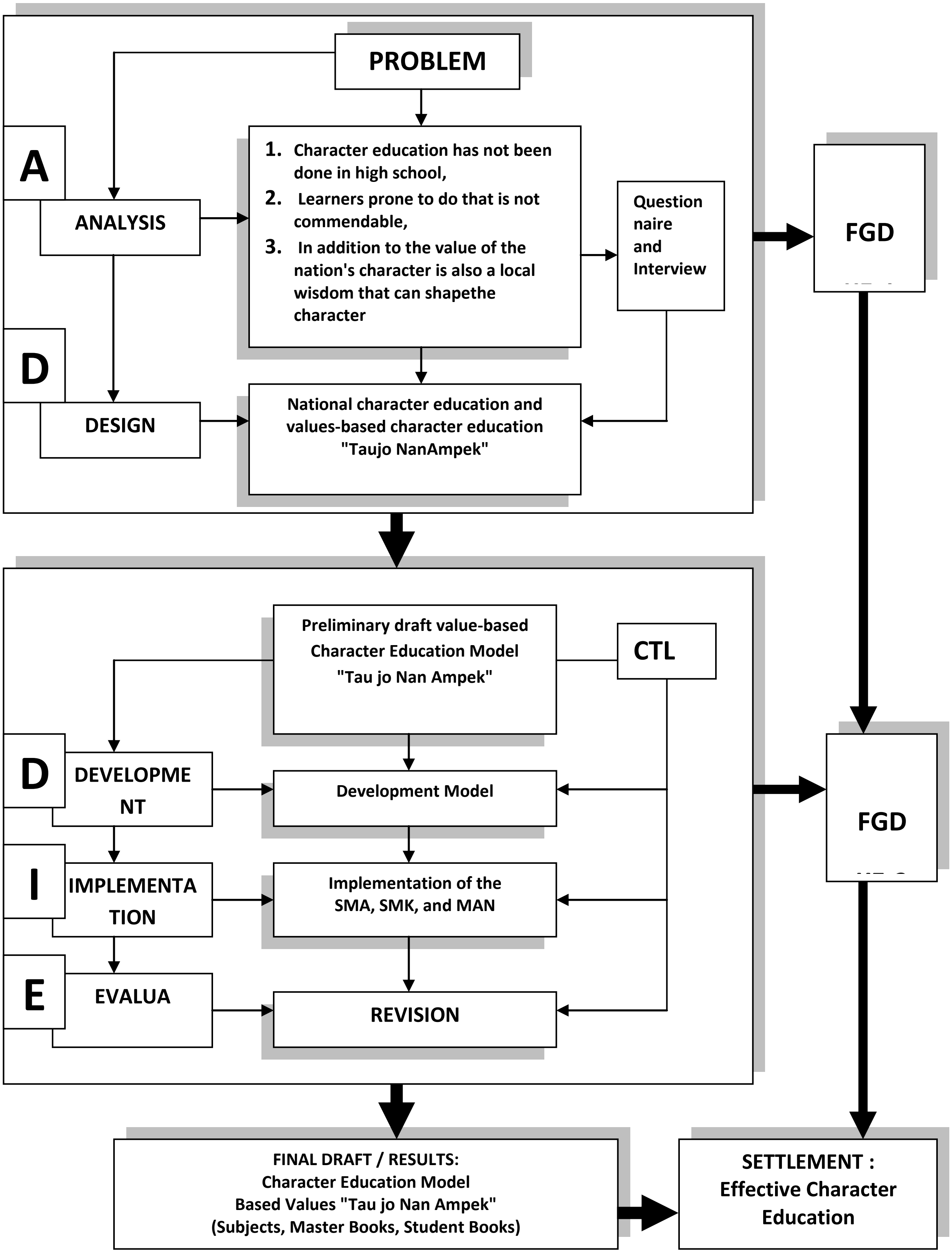
Local knowledge is also the basis for making decisions and set policies at the local level that have been fused with trust, norms and culture.One question is the value of local wisdom

values *Tau jo Nan Ampek*. Four or knowledge, ie the teachings paced containing four kinds of advice, manners, attitudes and behaviors that should be done. During this *Tau jo Nan Ampek* has become the identity of the Minangkabau and as a symbol of ethnic culture. Minangkabau people will be very sensitive, shy and despicable when it is said does not know the teachings of *Tau jo Nan Ampek*. Even the *Tau jo Nan Ampek* to dignity, dignity and personal glory in touch with yourself, other people, society, nature and with God.

The values of character *Tau jo Nan Ampek* consists of four kinds, namely road mandaki (how to climb), manurun road (way downhill), road records (horizontal way), and malereang roads (ramp ways). In connection with restrictions on the problem that has been stated above, the formulation of the problem in this study can be stated as follows.

1. Describing the implementation of character education in high schools in the City Batusangkar?
2. Describing the implementation of character education based on the values of *Tau jo Nan Ampek* in character education in high schools that include analysis models, design models, model development, model implementation, and evaluation of the implementation.

To illustrate the implementation of educational models of characters that have been implemented in high schools City Batusangkar, designed educational model right character and can be applied to students in high schools developed a model Analisys, Design, Development, Implementation, Evaluation (ADDIE) the model of learning CotextualTeaching and Learning (CTL). The development of character education model will be able to provide the benefits of theoretical and practical benefits. It is intended to provide input in the educational unit to provide guidance or as models in the implementation of character education in high schools, because so far there is no model-based character education values *Tau joNan Ampek*. Can provide input to the teacher in providing the materials with respect to character education based on the values of *Tau jo Nan Ampek* learner-high schools. It can also provide feedback on the learner in applying the attitudes and behavior of character, especially the values of *Taujo Nan Ampek*. It can then provide feedback to parents in the synergy of character education that been underway at the school with character education in the household and in society, and to give input to the Government of Tanah Datar in particular and the Government of West Sumatra Province in general in implementing character education based on values *Taujo Nan Ampek* to support the application of philosophy Indigenous *Adat Basandi Syarak, Syarak Basandi Kitabullah*.


PROBLEM
A
ANALYSIS
1. Character education has not been done in high school,
2. Learners prone to do that is not commendable,
3. In addition to the value of the nation's character is also a local wisdom that can shapethe character
Question naire and Interview
FGD
D
DESIGN
National character education and values-based character education "Taujo NanAmpek"
Preliminary draft value-based Character Education Model "Tau jo Nan Ampek"
CTL
D
DEVELOPME NT
Development Model
FGD
I
IMPLEMENTA TION
Implementation of the SMA, SMK, and MAN
E
EVALUA
REVISION
FINAL DRAFT / RESULTS: Character Education Model Based Values "Tau jo Nan Ampek" (Subjects, Master Books, Student Books)
SETTLEMENT : Effective Character Education

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In the book of *Alam Takambang jadi Guru*, Navis (1984: 98) call with the style or styles Kato said, that sort of manners spoke daily between fellow. It does not distinguish between the nobility, but just how to use it according to who the interlocutors. Furthermore Navis describes four different styles of the word is as follows :

a. *Kato Mandaki* (word climb), which is the language used by people whose social status is lower than his opponent spoke. For example used in people younger to older, students to teachers, and subordinates to superiors. The use of grammar neater, expression clearly, and use a substitute word the first, second and third bersfat special, ambo for the first person, call the honor for older people:*mamak, Inyiak, uda, bapak, etek, Amai,* or uni and he's the third person,
b. *Kato manurun* (words downhill), which is the language used by people of higher status than his opponent spoke. For example used mamak to his nephew, teacher to pupil, and superiors to subordinates.The use of grammar tidy, but with a shorter sentence. Said substitute the first, second and third special nature, den or crew wakwak den or aden (origin of the crew aden) for the first person. *Wakang* crew or to the two men, the crew you or wak you to the two women.*Waknyo* or crew for a third person. Said the crew or wak, which means the same to us, is always used as a statement that all are equal with us or among us too,
c. *Kato Mandaki* (horizontal word). That is the language used among people who have the same social status and intimate relationship. Language grammar usage is prevalent market put on the last syllable or words is incomplete and short sentences. Said substitute the first, second and third special nature, aden or den for the first person, second person ang for men, you're for the two women, inyo or anyo for a third person,
d. *Kato Malereng* (words incline). That is, the language used by people whose position is the same, mutual respect, as among those who have family ties by marriage, for example-in-law, a relative, in-law, and daughter, or between people who post are respected, such as princes, scholars, and teachers, The use of grammar neat, but more use of proverbs, such as metaphor, allegory or satire. Said substitute the first, second, third da is also a special nature. For example *wak ambo* or crew for the first person, and the degree of kinship given call for the two siblings. He's the third person.

The Effect Using Facebook as a Medium for Discussion to Improve Students' Writing of Recount Text of the First Year Students at SMAN 5 Pekanbaru, Riau, Indonesia

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Abstract

The purpose of the research is to find out the students' ability in writing, especially writing recount text by using Facebook as a medium of discussion. In the classroom students set up their Cellphone to write and discuss a recount text. The research question is "Is there any significant effect on students writing recount text by using face book as medium for discussion on students writing recount text to improve the students of SMAN 5 Pekanbaru?" On the preliminary study the writer found the students' writing ability was low. Hence, writer was interested in trying to solve the students' problem by implementing Facebook as a medium of discussion. The design of this research was an experimental research. It was quasi experimental of research. The researcher took one class as the sample of that consisted of 25 students. Cluster random sampling technique was used by the writer to take the sample. The technique of data collection was test. The researcher found the result of T was 12, 64. Then, compared to T-table from df = 24 that shows 12, 64 at significant level of 5 % it shows 2,06 and at level of 1 % it shows 2,79. It can be said that 2,06<12,64>2,79. It means that Tc > Tt. Ha is accepted. In other words, there is significant effect of using Facebook as a medium for discussion of writing recount text of the first year students of SMAN 5 Pekanbaru.
Keywords: *facebook, recount text, and medium*

INTRODUCTION

In the era of technology, social network is not a new term. Almost all people know what it is although they cannot define it. Based on my limited knowledge, I define social network as Internet-based social system consisting of many people from different places that are connected together to allow communication and interaction between them. There are so many kinds of social network, such as Path, Twitter, Interpals, Google+, and Facebook. On the other hand, Facebook one of the social networking which is students so familiar with Facebook and they use it almost every day in their spare time. In Facebook, the students feel free and enjoy writing their thoughts, feeling, and opinion in informal way.

Therefore, as a teacher we have to realize the special quality of implementing Facebook especially in teaching writing that Facebook offers new ways in of teaching which is never possible before. However, teacher must also be aware of the possible bad effect of it and continually examine the uses and outcomes of using it in teaching learning process.

Writing as one of the four language skills is part of syllabus in English teaching. It can be seen from the curriculum 2004, standard competency of senior high school (Depdiknas: 2003) starting the aim of English teaching is that students can communicate in English both oral form and written one. As stated by Finnocchiaro and Brumfit (1983: 149), "writing should reinforce and help extends the listening, speaking, and reading skill".

Writing is not natural skill because someone cannot acquire this ability automatically and easily. Writing skill differs from others skill like speaking and listening. The two other skills can be gained through natural process. Since someone was born, he was got great experiences of listening and speaking. In writing, he must recognize and understand new symbols. It is in schools that he gets knowledge of new symbols in the written from when beginning to understand the significance of letter on paper. Writing is therefore a sophisticated skill combining a numbers of different elements that must be grammatical connected. Writing is considered the most difficult to be learned and mastered because it involves some language components (spelling, language use, vocabulary, and punctuation). Writing requires the rules of English grammar, mechanics such as the correct use of verb and pronunciation and it also involves many aspects such as paragraph development, organization of content, and it demands standard form grammar, syntax, and vocabulary.

One of the texts that are often taught by English teacher in senior high school is recount text. This type of text is taught at the first grade students. Recount text itself defines as a text that tells about a story of events or experiences in the past. The purpose of this text is to inform or entertain the audience.

Based on the writer's experience of SMAN 5 that is one of the senior high school is located on Marpoyan, Pekanbaru. When the writer taught students in there, many students still have problems how to start to write a recount text. It might cause by several factors. The first is the students cannot write generic structure of recount text well (orientation, events, and resolution). They do not understand how to explore their ideas. The second is the students just know the features of recount itself, but they do not know understand how to make recount text systematically. The third is the students have problem to develop recount text be paragraph. They do not use grammar and vocabulary correctly. The fourth is the students have problem in writing content and mechanic. They cannot arrange be paragraph and cannot to write systematically. The fifth is the teacher has lack strategy in writing. The teacher does not use a method and materials as well as motivate students have to enthusiastic in writing recount text. They only teach of social function, schematic structure, and language features of recount text without teach how to develop a good paragraph, so it makes the students cannot write recount text properly. In addition, the teacher needs to have appropriate media, and Facebook can be media in teaching writing especially in writing recount text

The reasons of the writer uses Facebook that the students are widely gives opportunity and help them to express their individual ideas by having them share their ideas easily. For this reasons the writer propose a research in writing entitle **The Effect of Using Facebook Groups as a Medium for Discussion of Writing of Recount Text of First Year Students of SMAN 5 Pekanbaru**

Problems

Many problems that faced by the students of first year students of SMAN 5 Pekanbaru in writing recount text as follows: the first, the teacher does not use good media, and the medium is complication, so the students hard to understand. Besides the teachers, have a little ability about transfer their knowledge to students. In teaching process, the teacher should use the appropriate teaching media in the teaching process that makes the students understand English about writing recount text more easily.

The second is social function: the students do not understand the purpose of learning recount text, and then the generic structure, the students are hard to find such as, Orientation, the Events, and Re-orientation. The students' motivations of writing are low. The students do not know the goal of studying writing. Therefore, the problem of English language skills like reading, writing, listening and speaking should being master by the students.

The third, the students are afraid to ask and to understand about the material which they are studying, and if they do not understand it can make them bored and do not seriously in learning English. If the students have difficulty in understanding the meaning of a text during the learning process then the writer provides a shortcut to them in a way, asked students' to find the meaning in dictionary.

The Limitation of the Problem

It has been showed above that the students have many problems in writing text. In this research, the writer focuses on recount text because based on the English syllabus of year –X in the first semester, students are expected to be able to write a recount text especially personal recounts and recount text has some components there are organization, content, vocabulary, grammar, spelling and punctuation but the writer focused on organization, content, grammar, and mechanics.

The Research Question.

Is there any significant effect of Using Facebook Groups as a Medium for Discussion of Writing of Recount Text of the First Year Students of SMAN 5 Pekanbaru?

The Objective of Research

To find out whether there is a significant effect of Facebook Groups as a Medium for Discussion of Writing of Recount Text of First Year Students of SMAN 5 Pekanbaru

Hypothesis

The writer makes hypothesis as follows:

1. **The null hypothesis (Ho)**
   Ho: There is no significant effect of using Facebook Groups as a Medium for Discussion of Writing of Recount Text. **The alternative hypothesis (Ha)**
   Ha: There is significant effect of using Facebook Groups as a Medium for Discussion of Writing of Recount Text

LITERATURE REVIEW

General Concept of Writing

Writing is one basic skill in learning English beside listening, speaking, and reading. To write means to communicate using written language. In writing, all information is delivered through text.

Writing means producing or creating a piece of text. Like speaking, writing requires someone to produce language. Harmer (2001: 249) states, "Language production means that students should use all and any languages at their disposal to achieve a communicative purpose rather than be restricted to specific practice points". Therefore, the form of language produced is different among those two. Speaking produces language in oral form while writing does in written form. That‟s why those skills belong to productive skill (Harmer, 2001:246; Harmer, 2004:6).

According to Ruddell (2005:39), "Writing is the act of constructing meaning while transacting with texts". She adds that "In writing, the meaning was made through the combination of prior knowledge and previous experience; information emerging from text; the stance he or she takes in relationship to the text; and immediate, remembered, or anticipated social interaction and communication" (Ruddell, 2005:39-40). It means that in order to write something, a writer needs to have an idea or memory of certain event or phenomenon and be able to construct that idea or memory in a certain order so that the reader can catch the meaning concluded in the text.

According to Harmer (2001:255), "in writing, there are problems with grammar, vocabulary, handwriting, spelling, layout, and punctuation". It means that good content of writing only is not enough. A writer must also have sufficient language components like grammar, vocabulary, punctuation, and spelling to facilitate him/her in expressing his/her ideas, experiences, thoughts, and feelings. The writing should be organized well, too, in order to be able to be easily read and understood by the readers.

The Process of Writing

Writing is not as simple as putting text on paper. It needs a long process from planning until producing the final version of the writing. Harmer (2004:4) argues that the process of writing consists of 4 steps: (1) planning, (2) drafting, (3) editing (reflecting and revising), and (4) final version.

The first step of writing is planning. Before starting to write or type, writers need to plan what they are going to say. It can be done by making detailed notes, jotting words down, or simply planning in the head. Harmer (2004:4) proposes three main issues writers should think about when planning to write: (1) the purpose of the writing, (2) the audience they are writing for, and (3) the content structure of the piece.

The second step is drafting. In this step, a writer writes what he/she has been planned before. This writing is called the first draft because it is not finished yet. The writer should check it minutely and make changes and corrections before considering it as the final version of the writing.

Checking the first draft will direct the writer to edit it. This is the third step of the writing process. In this step, the writer makes changes and corrections due to the ambiguity, grammatical errors, disorganized orders, etc of the writing.

The last step of writing process is writing the final version. This final draft of writing is written after the writer has done with editing and revising the first draft. However, Harmer (2004:5) states, "writing process is recursive". It means that writers revise throughout the process, frequently moving back and forth among the steps. For example, when writers think that they have done the final version; they may change their mind and go back to re-edit, re-draft, even re-plan the writing. As stated by Harmer (2004:6), "Even when they get to what they think is their final draft they may find themselves changing their mind and re-planning, drafting, or editing".

Writing is communicating using text. Through writing, a writer communicates with the readers. According to Healey (2007:181), "Writers need to communicate with their readers, which include having a sense of audience and writing to the expectations of that audience, using peer review effectively, and revising and editing as needed rather than assuming that once is enough". Moreover, Healey (2007:181) states that "broadening the audience base can enhance motivation for taking the time to edit and revise". Therefore, it is clear then that the real communication with readers is very important. By sharing the writing with the readers or the audience, a writer can collect the feedback and review from them as means to revise his/her writing to be better. Revising once only by the writer himself/herself is not enough. A writer will need someone else to see the writing from another point of view to see whether there is any oddity or not in his/her writing. For example, a writer may made errors, ambiguity, or miss-spelled words in his/her writing. The writer may not be aware of that; however, the readers who realize the peculiarity can inform it to the writer so that he/she can revise the writing.

Recount Text

Recount is one of genres taught in Indonesian schools. According to Gerot&Wignell (1994:194), "Recounts are genre that retells events for the purpose of informing and entertaining". Similarly, Anderson & Anderson (1997:48) define "Recount text as a piece of text that retells past event, usually in the order in which they happened". The purpose of a recount is to give the audience a description of an event covering what occurred, when and how it occurred. Some examples of recount texts are: newspaper reports, conversations, speeches, television interviews, eyewitness accounts, and letters.

From the explanation above, it can be concluded that recount text is a piece of text which retells experiences or past events in chronological order for the purpose of informing, entertaining, or reflecting. In writing recount text, students can tell everything about their past experiences. They may also retell the experiences of other people such as family, friends, relatives, etc. The examples of recount text that can be met in our everyday life is diary writing. Some people get used to write everything happened to them in diary. Commonly, the things they write are factual events that they faced at the day. Another example of recount text is Facebook status. People tend to share what happened to them and their feeling about it with their friends on Facebook. They post statuses that tell about their experience, usually in a very simple form. These kinds of texts are concluded as recount texts. Therefore, they are typed in simpler form and way; maybe that is why Facebook users do not realize that actually they write recount text almost every day, yet many times a day. Moreover, they do not realize that they enjoy recounting their story on Facebook.

The word "medium" (plural: media) derives from Latin word *medius* that means "between", it refers to anything which carries information from source to receiver (Smaldino and Russel, 2005:9). Smaldino and Russel (2005:9) define media as means of communication and source of information. Another definition comes from Arsyad (2011:4-5). According to him, "media is a component of learning sources or physical aids in students" surroundings which contains instructional material that can stimulate students to learn". The examples of media process and product are improved, (2) learning media arises learning motivation, interaction between students and environment, an

d the possibility for students to learn independently based on their own ability and interest, (3) learning media copes with the limitation of senses, space, and time, and (4) learning media provides equal experience for students about phenomenon happens around them and enables direct interactionare videos, television, diagrams, printed materials, computer programs, and instructors.

Media is very useful to be used in teaching learning activity. Asyhar (2012:8) states that "learning media can be perceived as anything that are able to convey message from a source intentionally to create conducive learning environment where the receiver of the message can involve in the learning process efficiently and effectively". In line with this, Smaldino and Russel (2005:9) state that "the purpose of media is to facilitate communication and learning". It means that media is used not only to foster interaction between students–teacher and students–students but also to convey the learning materials.

Arsyad (2011:26-27) explains the benefits of using learning media as follows: (1) learning media clarifies the presentation of message and information so that the learning prs with teacher, society, and environment.

There are several kinds of media. According to Siemens &Tittenberger (2009: 22-23), media is divided into 5 types: text, audio, visuals, video, and games and simulations. Smaldino and Russel (2005:9) propose six basic types of media. They are text, audio, visual, motion media, manipulatives (object), and people. Furthermore, Asyhar (2012:44) groups media into visual media, audio media, audio-visual media, and multimedia.

Teachers have to be able to select the most effective media to be used in their teaching so that the intended learning goals can be achieved. Siemens &Tittenberger (2009: 22) present three steps of selecting media type as follows: (1) clarify the learning intent, (2) evaluate media affordances, and (3) select media.

Facebook as Learning Media

According to Bartlett-Bragg (2006:3), "A social network is a range of applications that augments group interactions and shared spaces for collaboration, social connections, and aggregates information exchanges in a web-based environment".

Merchant (2013:6) defines social networking as "the patterning of everyday practices of social interaction, including those that take place within family structures, between friends, and in neighborhoods and communities."

Another definition comes from Boyd & Ellison (2007:2), they define social network sites as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system".

METHODOLOGY

The design of this research is the experimental study that involves independent and dependent variable. The independent variable is Facebook and dependent variable is the writing skills. The independent variable is Facebook and dependent variable is the writing skills. This research focuses in two variables which used control group and experimental group. Control group is given pre test and post test only while experiment was being done, while experiment group was given pre test, treatment and post test.

Thus, this research is intended to analyze and interpret a certain population by finding at the relationship between the independent and dependent variables.

X Using Facebook (independent Variable)Y Writing Skills (Dependent Variable).

In this research the data was taken from students by giving the tests material and ask them to answer. There two tests; pre-test and post-test. The class was divided into two classes: experimental class and control class. The duration of the test was 45 minutes to conduct all the activities.

Population

The population of this research is all of the first year students in academic year 2013/2014. There are ten classes of the first year with total number of 280 students.

The technique used to determine the sample of this research was random sampling in which every individual in the population has the same chance of being selected for the sample. In this study, we took one class as the sample. The sample is class number X8 which has 25 students who have Facebook account.
In this study, the researcher uses two series of test, pre-test and post-test. This used as her research instrument to get the score of the students.

Indicators of the Research

Writing Skill test	Indicators	Topics
Pre-test	1. Grammar 2. Content 3. Organization 4. Mechanics	Unforgettable Moment
Post-test	1. Grammar 2. Content 3. Organization 4. Mechanics	My Holiday

THE RESEARCH PROCEDURE

1. Pre-test

The pretest was carried out to determine the early background ability of the students who are selected as the sample. In this case, the writer conducted pre-test to the class X 8.

2. Treatment

In the first meeting is treatment, we use Facebook and learning process during four meeting sessions. The writer taught the students by using the following steps:

In the second meeting, the teacher explains the material in the class, after that the teacher asks students to write a recount text which the theme is **My Bad Day**. They have to post their writing on Facebook and give comments or opinion about the text on Facebook. The last step is the teacher and students conclude the material together

Third meeting, the teacher explains the material in the class, after that the teacher asks students to write a recount text which the theme is **My Busy Day**, they have to post their writing on Facebook and give comments or opinion about the text on Facebook. The last step is the teacher and students conclude the material together.

Fourth meeting, the teacher explains the material in the class, after that the teacher asks students to write a recount text which the theme is **My Horrible Experience**, they have to post their writing on Facebook and give comments or opinion about the text on Facebook. The last step is the teacher and students again conclude the material together.

Fifth meeting, the teacher explains the material in the class, after that the teacher asks students to write a recount text which the theme is **My Holiday**, they have to post their writing on Facebook and give comments or opinion about the text on Facebook. The last step is the teacher and students conclude the material together as before.

3. Post-test

Post-test of experimental class is administrated after the fifth meeting. The result of post-test is analyzed and used as final data for this research.

Data Analysis Technique

According to Brown (2004:244-245), the scoring rubric of recount text is consists of some scoring criteria; the criteria are the *organization, content, grammar, punctuation, and vocabulary* with the rate of 1-20 for each aspect.

Recount Text Scoring Rubric

Aspects	Score	Explanation
Organization: Introduction, body, and conclusion	20-18	Appropriate title, effective introductory paragraph, topic is stated, leads to body, transitional expressions used; arrangement of material shows plan (could be outlined by the reader); supporting evidence given for generalizations; conclusion logical and complete.
	17-15	Adequate title, introduction, and conclusion; body of essay is acceptable, but some evidence may be lacking, some ideas are not fully developed; sequence is logical but transactional expression may be absent or misused.
	14-12	Mediocre or scant introduction or

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		conclusion; problem with the order of ideas in body; the generalizations may not be fully supported by the evidence given; problems of organization interfere.
	11-6	Shaky or minimally recognizable introduction; organization can barely be seen; severe problems with ordering ideas; lack of supporting evidence; conclusion weak or illogical; inadequate effort at organization.
	5-1	Absence of introduction or conclusion; no apparent organization of body; severe lack of supporting evidence; writer has not made any effort to organize the composition (could not be outlined by reader).
Content	20-18	Easy addresses the assigned topic; the ideas are concrete and thoroughly developed; no extraneous material; essay reflects thought.
	17-15	Easy address the issues but misses some points; ideas could be more fully developed; some

		extraneous materials are present.
	14-12	Development of ideas not complete or essay is somewhat off the topic; paragraphs are not divided exactly right.
	11-6	Ideas complete; essay does not reflect careful thinking or was hurried written; in adequate effort in area of content.
	5-1	Essay is completely inadequate and does not reflect college level work; no apparent effort to consider the topic carefully.
Grammar	20-18	Native–like fluency in English grammar; correct use of relative clauses, prepositions, modals, articles, verbs, and tense sequencing; no fragments or run – on sentences.
	17-15	Advanced proficiency in English grammar; some grammar problems do not influence communication; although the reader is aware of them; no fragments or run-on sentences.
	14-12	Ideas are getting through to the reader, but grammar problems are apparent and have a

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		negative effect on communication; run on sentences and fragments present.
	11-6	Numerous serious grammar problems interfere with communication of the writers" ideas; grammar review of some areas clearly needed, difficult to read sentences
	5-1	Severe grammar problems interfere greatly with the message; reader cannot understand what the writer was trying to say; unintelligible sentence structure.
Mechanics	20-18	Correct use of English writing convention; left and right margins, all needed capital, paragraphs intended, punctuation and spelling; very neat.
	17-15	Some problems with writing conventions or punctuation; occasional spelling errors; left margin correct; paper is neat and legible.
	14-12	Uses general writing convention but has errors; spelling problems distract reader; punctuation errors interfere with ideas.
	11-6	Serious problems with format of paper; part of essay not legible; errors in

		sentence punctuation; unacceptable to adequate readers.
	5-1	Complete disregard for English writing convention; paper illegible; obvious capitals missing, no margins and severe spelling problems.

Data Analysis

1. The individual score of the students, we use the following formula:

$$\boldsymbol{P = \frac{X}{N}\ x\ 100}$$

(Wayan and Sunartama, 1986:76)

Where: P : Individual Score
X : Correct Answer
N : Number of Scores

(Hatch and Farhady, 1982)

2. To find out the mean of each group, the writer used the formula as follow:

$$\overline{X} = \frac{\sum X}{N}$$

Where:
$\overline{X}$: The average score
$\sum X$: The number of individual score
N : The number of individuals

(Hatch and Farhady, 1982: 55)

3.Variance is used to measure the reliability of each group:

$$S^2 = \frac{\sum\left(X - \overline{X}\right)^2}{N - 1}$$

Where:
S^2 : Variance

4. Standard Deviation $\boldsymbol{S = \sqrt{\frac{\sum(X-\overline{X})^2}{N-1}}}$

Where:
S : Standard deviation
$\sum\left(X - \overline{X}\right)^2$: Sigma of individual deviation of students score
N : The number of students
1 : Constant number

(Hatch and Farhady, 1982:59)

5. After knowing the standard deviation of the mean score, the writer would calculate the t-test by using formula.

$$t - test = \frac{X_1 - X_2}{\sqrt{\frac{(S_1)^2}{N_1} + \frac{(S_2)^2}{N_2}}}$$

Where:

t-test : the value for comparing two means

1. X_1 : mean of the score in pre-test
2. X_2 : mean of the score in post-test
3. S_1 : standard deviation of pre-test
4. S_2 : standard deviation of post-test
5. N_1 : number of the sample in pre-test N_2 : number of the sample in post-test

(Hatch and Farhady, 1982: 105)

THE RESEARCH FINDING

There were 25 students who did pre-test and post-test. We gave problem description then asked to write recount paragraph based on the topic. The students' compositions were corrected by two raters. The aspects of writing which were evaluated are Content, Organizations, Mechanics, and Grammar

Based on Table 4.2, the writer found that the total score for the students' pre-test at the posttest given by Rater 1 was 1384 points with the average score was 55,36 points, while Rater II was 853 points with the average score was 33,84. Furthermore, the accumulative score by two raters was 1387 points with the average score was 55,84 points.

Based on the accumulative and average score given by three raters, the writer concluded that that the control group's average comprehension about "content, organization, vocabulary, and grammar" So, the writer wished that they could get better score in writing Recount text by giving them series of teaching process for four times in the classrooms through using facebook's groups as a medium for discussion of writing recount text.

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The Results of Writing Recount Text at the Pretest

No Samples	Rater I	Rater II	Total
1	54	58	56.0
2	56	56	56.0
3	58	59	58.5
4	44	52	48.0

5	50	50	50.0
6	52	52	52.0
7	40	44	42.0
8	46	46	46.0
9	46	46	46.0
10	52	52	52.0
11	64	64	64.0
12	44	48	46.0
13	64	64	64.0
14	48	48	48.0
15	58	58	58.0
16	59	56	57.5
17	60	56	58.0
18	64	64	64.0
19	61	58	59.5
20	62	58	60.0
21	54	54	54.0
22	60	60	60.0
23	56	55	55.5
24	64	64	64.0
25	68	68	68.0
Total	1384	853	1387
Mean	55,36	33,84	

Conclusion

- The students' ability in writing recount text taught by using Facebook Groups as a Medium Discussion of Writing of Recount Text of First Year Students of SMAN 5 Pekanbaru, the majority of students' ability in writing recount were in very good level.

- The writer found that there was a significant effect using Facebook Groups as a Medium Discussion. It can be conducted that Ho was rejected and Ha was accepted. In conclusion, teaching English by applying Facebook Groups as a Medium Discussion of Writing of Recount Text of First Year Students of SMAN 5 was successful to increase students' ability

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MODEL DEVELOPMENT OF SOCIAL CAPITAL COMMUNITY DISASTER RESPONSE TO FLOOD PRONE DISASTER AREAS IN PADANG

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Abstract

The purpose of this research is to create a model of social capital development community disaster response in areas prone to flood disasters in the city of Padang. The research involved some activities as follow, 1. Conducting a social capital community disaster response in areas prone to flood disasters Padang, 2). Conducting analysis of key elements of social capital community disaster response areas prone to flood disasters Padang, 3). Formulating a model of the development of social capital of community disaster response in areas prone to flood disaster in Padang. This research resulted some conclusions 1. The advance of the systems in areas affected by flash floods is still awake, gotong royong system is still a mainstay in the building of a relocated house. 2). Analysis of key elements of social capital community disaster response areas indicated that: preparation aspect can be implementednot only in the form of equipment and infrastructure but social capital and mental attitude in public life implemented in form of gotong royong should be maintained, cooperation and mutual trust, not just in between fellow sepersukuan only. 3). Development of model of social capital community should use social capital as an adhesive for each individual, in form of norms, trust and networks, resulting in mutually beneficial cooperation to achieve common goals and the need for a social networks (networks of civic engagement) as a bond/social networks that exist in society, and norms that encourage productivity of the community.Therefore it is suggested: 1). Social capital in the communities can be used as input as well as a reference for all elements in the society and has to be developed further. Therefore it is recommended especially to the Government of Padang in order to carry out such activities in preparation to such disaster strikes, 2). The Government of Padang has to develop social capital soon in the disaster prone areas complementing to mitigation policies in relieving flood disasters occurred in the city of Padang.

Keywords: social capital, disasters and floods, mitigation, gotong royong.

INTRODUCTION

Incident in the city of Padang in the form of flood disasters had occurred several times which resulted in many casualties, both victims materially and morally victims. The flash flood that hit the city of Padang for the second time since the month of July and of September 2012, the flood came suddenly mixed the mud with a brownish color was directly hit a bridge connecting the Village Kapalo Koto with Village LambuangBukik, District Pauh, Padang City (http: //tvonenews.com, 2012).

Model development of the concept of social capital (social capital) became one of the important components in response to the disaster came. The preservation of nature and human safety are placed as an important subject that determines how they actin facing such disaster. Participation and capacity to organize themselves areimportant so that the community can play a role in dealing with a disaster.

Application of social capital in the flash floods in the city of Padang needs to be studied in depth. The society tends to use their land not in the accordance with the allocation and deviate from the RTRW Kota Padang, other than that at the time of the disaster, people tend to save her, despite the people around. Based on this reason the authors are interested toperform a study entitled "**Social Capital Community Development Model for Disaster Response in The Flood Disaster Prone Areas in Padang**".

RESEARCH METHODOLOGY

This research was conducted in the city of Padang on the following considerations:

1. The city of Padang have areas prone to flash floods that have been used as residential areas
2. The selected location has the characteristics of the region that support the occurrence of flood disasters with the level of danger is relatively diverse.

The timing of the research from proposal preparation to report writing phase II studies isone year, from July 2014 until July 2015.

Types of research

Type of research is qualitative.

Data Sources and Data Collection Techniques

Sources of data are the primary data and secondary data, while the technique of data collection was done by direct observation in the field and interviews with informants through documentation.

Examining the Key Elements are prioritized to be Developed in the Social Capital Community Disaster Response Floods

Data was collected through interviews, discussions, and questionnaires with: community, a group of experts / specialists / NGO (Universities, environmental NGO), the city government (Department of Spatial Planning, BAPEDA), LKAAM and private.

Data analysis technique

Data analysis is the process of organizing by sorting the data into patterns, categories and a basic outline that can be formulated themes and assumptions can be formulated as follows. Some steps in research with qualitative methods (Milles and Huberman, 1992): data reduction, data presentation (display), inference (conclusion) and FGD.

RESULTS AND DISCUSSION

1. Genesis Flood

Flash floods (flash flood) is flooding due to runoff out of the river flow for streamflow enlarged suddenly beyond the capacity of flow, occurs quickly hit areas of lower surface of the earth, in the valley of the rivers and basins, and typically carries debris in flow (Directorate General of Water Resources, 2012). The flash flood that hit the city of Padang in 2013 devastated some areas that are located along the BatangKuranji and much harm the residents or casualties.The most worstarea which were affected by flash floods the worst found in the village of Padang Besi, and KelurahanLambuangBukik that destroyed a residential community. Meanwhile, in the village of Koto Kapalo damaged the rice fields and settlements. To face this social capital is very important in society.

The following discussion of this study are:

Floods that occurred in the city of Padang, cannot be propped up only to the phenomenon of natural events alone (high rainfall), because there is no single cause of the dominant, but flash floods have occurred due to various factors (geomorphology, soils, land cover, climate, and social society).

In geomorphological conditions in the upper reaches of the landscape is dominated by steep slopes until very steep. This watershed morphometry oval shaped with a fairly large gradient (10 to 20%), which in some places upstream, naturally these rivers form the natural dams that in the event of flash floods plus triggered by heavy rainfall.This dam then burst and cause acceleration of the flow of water and other materials (stone, mud, wood, etc.). The second upstream part of the basin is that it should have functions and Tahura Conservation Forest region, thathas suffered partial damagemagnitude.Soil that sustains the upstream part is kind regosol with high ability to store water.

2. Social capital Community Disaster Response On Flood Disaster Prone Region of Padang.

Social capital is identified and described differently. Pretty and Ward (2001) identified four major aspects of social capital, namely: a relationship of mutual trust, an exchange, common rules, norms and sanctions, and linkages, networks and groups.

a. Shape Damage

Damage caused by flooding Bandang in 2012 in the form of loss of wealth in the community which has damaged housing residents in the Village LambuangBukik and 4 people died, while the Village of Limau Manis also destroys houses while the village Kapalo Koto are kehancurkan on bridges and paddy population, so many population loss of rice paddies and fields, while in the village of Padang Basi damaging many houses and public facilities such as mosque and others, but the damage and losses are most numerous in the Village Hull Bukik. Ini according to an interview with Mr. Head LubukKilangan and Key Informants plus the data by a mother who took part in the event of flash floods as witnesses living in Lubuk Kilangan Head Office.

b.Form Help of Various Parties

Forms of assistance given to communities affected by the flash flood was received attention from local authorities and cooperating with the head of customs, while the form of assistance provided are: the area LambuangBukik because severe and claimed four people, residents receive assistance from BPBD (Firm Penanggulang Regional Disaster) center and TBO (Mine stone Bara) Bukit Asam as many as 29 heads of family and help the soil to allocate housing in the village of Batu Foul degan area 7300m2, so that each head of family get 200m2 per family relocated area hills but this constrained by the location of the steep slope of 45 degrees over and access to the area is the limiting factor for the community, but not all msyarakat get help, only 44 KK, in terms of the number of households that were affected by flash floods as much as 66 kk 22 KK more staying still relatively prone to flooding and they still chose to remain at home, which is prone to flash floods. Despite the high risk, it will find a way out, because a problem with the communal land then in priority by traditional leaders are people who sekaum or the same and can be taken for free, but that is not of the same then it must redress at a cheap price. This data was obtained from interviews with an interview with Ms. headman Padang Besi and two of Key Informants in the village of Padang Besi.

In the event of flash floods rock forms are given in the form of food assistance, mats and blankets are a necessity for the citizens, such assistance coming from various parties, none from political parties and governments an organization other, in antarany PT Semen Padang, BASDA and PT cigarettes, TAGANA community groups (groups tanggab disasters) as well as social groups, namely: KSB (disaster Preparedness group) but nevertheless support personnel come from various parties, such as neighboring communities and PMR students who come from the campus.

c. Sistem kekrabatan and trust

The alliance system in areas affected by flash floods is still awake, system gontong royong is still a mainstay in building a house relocated, the land given by indigenous leaders to build a house for each family whose land has been lost or dangerous to stay at home they, the government subsidized funds in each house each family head by 25 million, while for the development process in gontongdalakukanroyang to complete. The data we have obtained from interviews with Mr. Head Social Affairs and Key Informants consisting of one man and one headman RW as well as some community leaders in Head Office Pauh.

d. Post-disaster life

In communities affected by the flood disaster in the district Pauh, LubukKilangann, Kuranji and Nanggalo, at the time of their disaster, is still not out of the norms and rules that apply where at the time of the disaster came each group to help other groups without regard social status and social groups wherever, they all were given help and a lift while they are in need, groceries donated from various groups and organizations berdaatangan that assistance from the department of Public Works (PU), group Ready for Disaster (KSB) group KSR campus in the city of meadow and PMPB western Sumatra this form of blankets, food and membantuk save possessions that can still be used without taking into account personal interests, all citizens around the affected area to offer assistance to arrive and it constituted the soul adnyagotoroyong and mutual trust between each other.

Relocation of new residents in the Village LambuangBukik.

Road to the steep location, a vehicle that can get there is a motor driven by the professional community as well

When researchers find Mr. Ahmad who was repairing drainage and researchers conducted interviews about the social capital of the community about the flood.

Trusting relationship (trust) will basically build cooperation, which can reduce the cost of transactions among people in the community. The people of the affected flood looks still lack of mutual trust among themselves between the groups or tribes or between individuals, it can be seen from the way petrified groups affected by disaster, they came to the place the scene with the needs of the mukin can be used by the society affected musibahdan those with besarhati carry and to offering them a ride home to tiggal together up to them for a while.

3. Model development of social capital of community disaster response in areas prone to flood disaster in Padang.

Results of research on the strengthening of social capital in the community to respond to disasters in areas prone to flood disasters. Strengthening social capital is only considered as a developing network of relationships (physical) between the components of trust (trust), the Network of employment (net-work), and collaboration (cooperation), most often raised by the expert (economic) in developed countries. It is still considered not directly touch the root or core of strengthening social capital itself. According to the study of social capital is the core values of the local culture.

Communities that are disaster-prone region has a horizontal relationship is relatively strong compared with other places. In the study results suggested that aspects of the trust or trusts into forming a major component of social capital in a flood area Bandang. There is a comparison of four research locations on this aspect of social capital. social capital elements under study are: (1) the government, (2) leadership, (3) the relationship between tribes, (4) solidarity, (5) Mutual cooperation, (6) Belief / faith and (7) networks. Qualitatively it can be concluded that the most powerful social capital possessed by the people in the flood area Bandang mutual cooperation, solidarity and tribalism have been living side by side.

The values of trust in society can be seen from the frequency of meetings that tend routine in the institution every month. It is a form of trust among citizens is an element of social capital. Then there is an element of social capital that is solidarity among citizens. It can be seen from a sense of belonging among members so that the harmony and unity of residents increased by way of friendship, exchange experiences, kekompakaan and others. Fraternity in disaster-prone areas is much influenced values primordial or ascriptive. Then the values of trust, solidarity, cooperation networks are used as capital in the improvement of other functions, such as increased respect and mutual benefit.

Putnam (1993) state social capital components consist of confidence (trust), rules (norms) and networks (networks) that can improve the efficiency of the facility in a community through acts of social terkordinasi.Modal actually conducive to development , Social capital can be developed and optimized in the form of institutional-social organizations at the community level to strengthen the disaster response community.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. Analysis of social capital, kinship systems in areas affected by flash floods is still awake, gontong system royong is still a mainstay in building a house relocated.
2. Analysis of key elements of social capital, preparations can be prepared not only in the form of equipment and infrastructure but social capital and mental attitude in public life should be maintained in the form of gotoroyong, cooperation and mutual trust, not only among fellow sepersukuan on course.
3. Model development of social capital of community disaster response in areas prone to flood disasters by using social capital as an adhesive for each individual, in the form of norms, trust and networks, resulting in mutually beneficial cooperation to achieve common goals and the need for a social networks (networks of civic engagement).

Suggestion

1. To the government of Padang in order to carry out activities to develop social capital so that when disaster strikes they suadah ready to face.

2. That the Government of Padang soon develop social capital in disaster prone areas in addition to mitigation policies against flood disasters that have occurred in the city of Padang

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CLEAN LIVING IN MODEL MANAGEMENT LUBUAK MANGINDO, JORONG III SANGKIR, LUBUK BASUNG DISTRICT, DISTRICT AGAM

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Abstract

This study aims to determine: the management model of clean living in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. Using a combination of quantitative and qualitative methods with the type of method used is a combination of Sequential Explanatory. The research location is in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. Samples were taken by random sampling with a sample of 64 households. They are the people who reside in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. Qualitative data were collected through interviews. The data obtained are presented descriptively and analyzed with path analysis (path analysis). Informants were selected using snowball sampling technique that samling, namely the communities in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. Results of the study: 1) Local knowledge significantly influence people's behavior in managing the clean life in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam, Forms of knowledge on managing the clean life do so not many mosquitoes at home, to live a healthy, if we maintain the cleanliness of our homes, it seems more beautiful to behold,2) There is the influence of local knowledge and attitude towards the behavior of people in managing the clean life in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam, His is done to society by providing an example of the daily actions in order to pay attention to health, for example, do not take out the trash, clean the entire house from the outside yard to the kitchen, and 3). Model knowledge Minangkabau society in managing a clean life, comes from nature, and in accordance with the Depkes to shape attitudes and behavior they manage a clean life. Suggestions: 1). to BAPPEDA Agam, relevant authorities to be able to conduct counseling, to traditional leaders, niniak mamak and religious leaders to urge people to manage a clean life, 2). to the community in Lubuak Mangindo to always manage to live clean, in order to create healthy, beautiful and wonderful.

Keywords: Models and Management of Clean Living

INTRODUCTION

Management of the environment is an integrated effort to preserve environmental functions include planning policy, exploitation, development, maintenance, restoration, monitoring, and control of the environment. Since environmental management oriented to economic interest or it can be said anthropocentric, it will tend to efforts or exploitative activities on the environment. To meet the interests, human beings often tend to commit sins against the environment (environmental sins). This is where the human consciousness towards the environment preservation tested.

Since the last three decades of environmental entering an alarming stage. According to Todaro (1995), states that 29% of the earth's land has decreased only between mild, moderate and severe, while 6% were classified as severe decline. The tropical forests which cover 6% of the earth's surface area, but has a high biodiversity which is about 50% of the number of existing species, between 7.6 million hectares till 10 per yaear suffered extinction.

The efforts made by the United Nations on the human environment is to hold a conference in Stockholm, for example, has been extrapolated formulation of national environmental policies on sustainable development (ecodevelopment), which was then poured in Article 1 paragraph (3) of the Management of the Environment (Law No. . 23, 1997, hereinafter referred to as UUPLH).

Goal clean lifestyle is a society that is in in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. In Article 5 to Article 7 of Law No. 23 of 1997 on Environmental Management (UUPLH), arranged on the rights, obligations and community participation. Such community is the entire community, including students (from kindergarten to university). Some peoples' rights referred to in Article 5, namely: 1). Everyone has an equal right to a good environment and healthy, 2). Everyone has the right to environmental information relating to the role in environmental management and 3). Everyone has the right to play a role in the framework of environmental management in accordance with the legislation in force.

In addition to the rights granted by law, the public is also required to comply with certain obligations in environmental management. The obligations stipulated in Article 6 UUPLH, namely: 1). Everyone is obliged to preserve the function of the environment and prevent and mitigate pollution and destruction of the environment and 2). Everyone who does business or activity must provide true and accurate information about environmental management. The obligation of every person mentioned above is not of their position as members of the community that reflects human dignity as individuals and social beings. This means that every person joins role in efforts to preserve the environment, for example, community participation in developing a culture of a clean environment, super visions outreach activities in the environmental field.

Implementation of clean lifestyle by society then the environment will shape them to have the ability and self-reliance in preventing disease, improving their health and play an active role in the realization of clean environment. The emergence of various diseases that often attack people turned out to be generally associated with improved hygiene behaviors. Then planting the values of hygienic behavior in society is an absolute necessity to empower people so that they know, willing and able to practice hygienic behavior and play an active role in creating a clean environment. This is what encouraged to conduct research with the title "**Model Management of Clean Living in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam**".

RESEARCH METHODOLOGY

Based on the research questions, it is conducted in a manner that is:
Using a combination of quantitative and qualitative methods. This type of method used is a combination of Sequential Explanatory. According Sugiono (2012: 409) explains that the combination of Sequential Explanatory done with data collection and analysis of quantitative data in the first stage, followed by the collection and analysis of qualitative data in the second stage, in order to strengthen the results of quantitative research conducted in the first phase. The benefits of this research by Brannen (2008: 67) are: to provide background data measured from quantitative research so as to provide the basis for the data in case of certain groups that will underlie intensive study in qualitative research. Meanwhile, according to Jonathan (2011: 46) mentions this model as a sequential explanatory design that perform quantitative research first, followed by qualitative research, so a qualitative approach as a continuation of the quantitative.

The reason for using this method in accordance with the opinion of Sugiono (2014: 77) that, in addition to the validation data and the researchers also want the results of qualitative research can be applied to a very broad population. The rationale for this combination method also follows an explanation of Jonathan (2011: 6-8), is: "the need to adapt to the different research questions (different serearch question), the reason for the enhancement of research and quality assurance also to triangulation, so as to obtain findings more accurate".

Research steps according Sugiyono (2013: 487) is:

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Quantitative methods, testing hypotheses

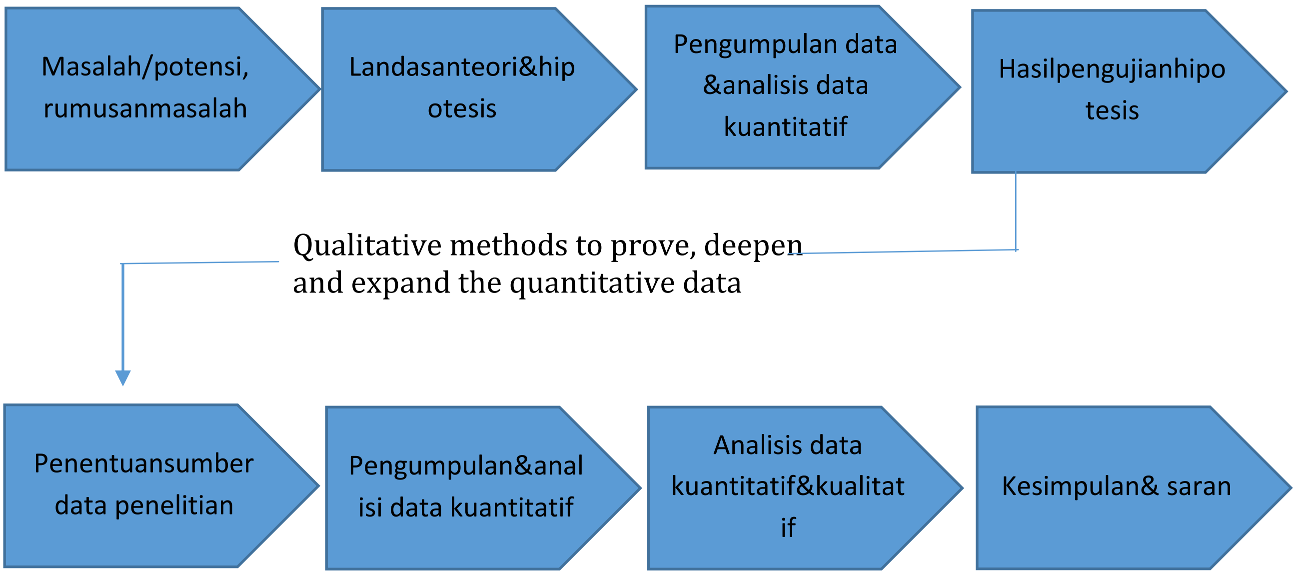

Figure Steps in the design Sequential research Explanatory

RESULTS AND DISCUSSION

Community knowledge in managing the clean life in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam regency, Knowledge of the management of clean living for one community to do so glad eye view, cleaning is necessary, if there are no jobs then it could clear up what appears alone, the likes are cleaned. This is a behavior that is not maximized taken in the management of clean living, because clean only as needed, clean the visuals. Supposed to do clean-up activities for the improvement of health. Another public opinion to say that not many mosquitoes at home, to live a healthy, if we maintain the cleanliness of our homes, it seems more beautiful to behold.

Related be Nefilinda research (2015) obtained a value of F test is known that the Farithmetic1.535 with a significance value of 0.220. Means the exogenous variables significantly influence the endogenous variable, so it can continue to test individually, meaning that local knowledge significantly influence people's behavior in managing the clean life in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam regency, so the alternative hypothesis formed acceptable.

This is consistent with the objective of a clean and healthy living behavior by health office (2006) is to improve the knowledge, awareness and willingness of people to live healthy, active and increasing the role of society including the private sector and the business world, in efforts to achieve an optimal degree of life. To achieve Human

Development Index which measures the achievement of whole country. This achievement includes three indicators such as education level, health status and economic ability. The maintenance of public health would boost productivity performance of society so as to improve the welfare of the community. Therefore it becomes a necessity for all parties to maintain, improve and protect the health of the whole community for the welfare of Indonesia (Health, 2009). By increasing the knowledge society itself.

Behavior clean and healthy life is an attempt to provide a learning experience or creating a condition for individuals, families, groups and communities, with open lines of communication, provide information and educate, to 16 improve the knowledge, attitudes and behavior, through the approach of the leadership (advocacy) , build atmosphere (social support) and empowerment (empowerment) so as to implement ways of healthy living in order to preserve, maintain and improve public health (health, 2006).

This is evident from the attitude of society if there are people who can not manage to live clean then the public reprimand by informing to the neighbor, so clean her house, how many bins are not pleasant to look at, plus it become mosquito breeding. Attitudes conducted by the public by giving an example with daily actions in order to pay attention to health, for example, do not take out the trash, clean the entire house from the outside yard to the kitchen. While our behavior is only to say, but he spoke well, because we are different, not to offend others.

Related be Nefilinda research (2015) note that the F test results calculated F value of 1.217 with a significant value of 0.303. Means all of the exogenous variables significantly influence the endogenous variable, so it can continue to test individually. Based on the above results it can be seen that there are significant local knowledge and attitude towards the behavior of people in managing the clean life in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam. The path coefficients significant local knowledge of the behavior of the community in managing the clean life.

According to Azwar (2005) suggested that factors that can affect the formation of attitudes are: 1) Personal experience can be the basis for the formation of attitudes, personal experiences should leave a strong impression. It involves an emotional state that appreciation will experience a deeper and longer lasting. But this dynamic is not simple because a single experience that is rarely the basis for the formation of attitudes. The bitter experience though rarely to be apart from one's memory even though there is a sweet impression of the experience itself. 2) Culture has a great influence on the formation of a person's attitude. Without us knowing the culture has instilled line influences our attitude towards various issues. Culture also has coloring attitudes and not colored experience to individuals who become members of the community care. Only the individual personality that has been established and the strong who can tarnish cultural domination in the formation of individual attitudes. 3) Someone else is considered important Others around us is one of the components of social influence attitude join us. Someone will emulate and behave just like everyone else if the person is considered to deserve to be a role model. 4) Media Influence of mass media is not too great in the interaction of individuals directly, but in the process of formation and change of attitudes, the role of mass media in no small means. In the submission of information as the main task, the mass media also carry messages which contain suggestions that can lead a person's opinion. 5) Education Institute and the Institute of Religious educational institutions and religious institutions as a system has an influence in the formation of attitudes because both of them lay a foundation of understanding and moral concepts within the individual. The concept of moral and religious teachings is crucial belief system it is not surprising that, in turn, then that concept played a role in determining individual attitudes. 6) Influence of Emotion Factor A formation of a person's attitude is not determined by the state of the environment and personal experience but an attitude is based on an emotional statement that serves as a kind of channeling frustration or alienation of ego defense mechanisms. An attitude that is based on emotional is prejudice that intolerance towards groups of people.

According to the Health Office (2006) clean lifestyle that includes about: 1). There is a toilet, including the use and maintenance 2). There is clean water and healthcare utilization for 3). There is trash and management 4). There sewerage and management 5). There are vents 6). Occupant density 7). Not the ground floor. Meanwhile, according to Depkes (2011) there are some benefits to the community on the implementation of clean and healthy behaviors, namely: 1). The public is able to pursue a healthy environment. 2). Community to prevent and cope with health problems. 3). Community utilize existing health services. 4). People are able to develop Sourced Public Health Effort (UKBM) such as neighborhood health center, maternity savings, gathering latrines, village ambulance and others.

Which became Model Management of Clean Living in Lubuak Mangindo, Jorong III Sangkir, District Lubuk Basung, Agam is a form of knowledge was initiated by the communities of their family environment respectively. Minangkabau people acquire knowledge of "*Alam Takambang Jadi Guru*", the intention is that people learn from nature, his knowledge comes mostly from nature is heard, seen them everyday. So that the behavior of Minangkabau society that comes from the knowledge gained from nature that can be applied in attitude and behavior to manage your life clean. If the attitudes and behavior are good in managing the clean living will increase health anyway.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the results of research and discussion, then a number of conclusions, namely:

1. Local knowledge significantly influence people's behavior in managing the clean life, Forms of knowledge on managing the clean life do so not many mosquitoes at home, to live a healthy, if we maintain the cleanliness of our homes, it seems more beautiful to behold.
2. There is local knowledge and attitudes influence the behavior of people in managing the clean life, this is done to society by providing an example of the daily actions in order to pay attention to health, for example, do not take out the trash, clean the entire house from the outside yard to the kitchen.
3. Model knowledge Minangkabau society in managing a clean life, comes from nature, and in accordance with the Depkes to shape attitudes and behavior they manage a clean life.

RECOMMENDATIONS

Based on the above conclusions, the authors give advice which may include:

1. To BAPPEDA Agam, relevant authorities to be able to conduct counseling, to traditional leaders, Niniak Mamak and religious leaders to urge people to manage the clean life.
2. To society in Lubuak Mangindo to always manage to live clean, in order to create healthy, beautiful and wonderful.
3. For the public to be more aware of the importance of maintaining a clean living that can be sustained by following the guidance and instruction through counseling, and so forth.

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COMMUNITY DEVELOPMENT MODEL THROUGH LANE CRAFTSMEN NONFORMAL EDUCATION EMBROIDERY IN PESISIR SELATAN DISTRICT

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Abstract

Product of this development for the long term is to be an interesting and useful material in the process of community empowerment especially the artisans. This product will facilitate the implementation of community empowerment by trainers, craftsmen and related agencies. While the specific objectives to be achieved are:

1. Design the development model of community empowerment with training methods that can improve the quality of skills of craftsmen.
2. Validate the development model of community empowerment associated with the development of embroidery designs and motifs that can improve the quality of skills of craftsmen.
3. The effectiveness of the development model of community empowerment to improve the quality of the skills of craftsmen.

To achieve this, researchers used a method of research and development (Research and Development / R & D). Methods of research and development (R & D) is used if researchers want to produce a particular product, and also to test the effectiveness of a product.

By knowing the design of the development model of empowerment for the community of craftsmen in accordance with the characteristics of ethnic researchers will give birth to a product in the form of: (1) training manual for community empowerment craftsmen, (2) book development module design and motif embroidery for craftsmen, (3) handbook Trainer working for.

Keywords: empowerment model development, embroidery artisans, non-formal education

INTRODUCTION

Empowerment as an alternative concept of development, which in essence gives the decision-making autonomy pressure of a community, which is grounded in personal resources, democratic and social learning through direct experience. Lucie Setiana (2001: 6) suggested the community empowerment is an attempt to increase the dignity of people who under present conditions is not able to escape the poverty trap in order to realize the prosperity, well-being and peace of the community. In other words, is to enable and empower the community's independence.

Craftsmen is a human resources (HR) in nation building, even as human resources is one of the most important resources in addition to natural resources, the resources of science and technology, and other resources in the development of a nation. Without HR is not possible to do an activity, including construction. In the context of resource development craftsmen, education and training is an attempt to develop human resources, especially to develop intellectual abilities and personalities, and skills (skills) of the craftsmen.

The potential of community-owned local artisans, especially women in villages barung-barung Belantai and communities that support potential optimally empowered so as to give effect to the communities and regions which in turn impact on improving the welfare of their families and have great significance for the development of the nation. By knowing the community activities particularly women artisans village barung-barung Belantai and product yields and the impact it will bring the views of women in important positions in kedinamikaan culture that flourished mainly in hubugannya with art, so expect artists gave birth to female artisans are able to create Products- creative and innovative products.

Crafts embroidery is also a vehicle for aesthetic, revealer sense of beauty, things looked on pencorakannya was carefully and thoroughly. Most style has a symbolic meaning, the opposite of the philosophy of Minangkabau people living in placing himself at the center of the universe, and many decorative shades. The beauty of it not only looks and born of diversity configuration, shape, style and coloring, but also derived from technical diversity. Aspects of aesthetic, technical, and psychological embroidery has become an important factor in the manufacture and use embroidery as a customary fashion. The more finely made, the greater the value profannya and increasingly well respected owners in the community.

Embroider activities in centers of handicrafts produced fabrics embroidered clothing / apparel, mukena with shadow embroidery techniques and applications. As household crafts embroidery industry in villages barung-barung Belantai, this effort would need to be developed, so as to have artistic value and sale value was good anyway. The development of embroidery industry has become a top priority in preserving the craft households, especially for women in West Sumatra Province. Embroidery industry development goals is to develop the creative industries, increasing value added, employment, which is expected to increase the income of the people, especially women.

Developing innovation and creativity create designs and motifs embroidered products are in demand according to market needs. Through research of this development will be tested to find innovation and creativity in the shadow embroideries and applications residing in the Pesisir Selatan. Along with the development of science, technology and art and culture, which affects the pattern of community life, including the use of embroidery as clothing materials. Now embroidered fabrics are not only used as a customary fashion, but has evolved into a variety of purposes, such as daily fashion and interior household devices.

Production of quality handicrafts artisans requires expertise in the development of designs, motifs, embroidery workmanship techniques. The discourse about the embroidery fabric is part of the discourse of human civilization. Embroidery became a vehicle for cultural expression, both in its conceptually and practically. Embroidery became refresentasi of spiritual beliefs, worldview, identity, status, wealth, artistic tastes, and human invention.

In the review of patterns embroidered cloth, he grew out of the needs of the internal culture (associated with customs, rites and beliefs of the local) community, embroidered fabrics generally shaped and styled stylization or abstraction of flora and fauna. The shape and style departed from the terms and nature of indigenous religious beliefs Minangkabau society as a manufacturer. Its manufacture requires a high human physical involvement (usually done manually / handmade).

Issues related to the design of the creative economy, and then offered to the public or designs follow the market. Design motifs are developed, rooted in nature takambang motives for indigenous Minangkabau, this can be explored through creativity, as local color shows ikonitasnya. Nature was the inspiration in the formation of motifs and forms, as well as the natural motion is interpreted by the human life which later became stylized arrangement of lines and circles that are decorative.

Research methods

This research is a development (Research and Development), which leads to the empowerment of artisans. Selection of types and models of research and development in accordance with the subject matter of research and research purposes as well as how to work practically. Development of research methods used to develop and test products and the second phase of the research with quantitative methods (experiment) is used to test the effectiveness of the product (Sugiyono, 2011: 494). Model and research steps will be carried out based on model research and development ADDIE (Analysis, Design, Development, Implementation, Evaluation). ADDIE emerged in the 1990s developed by

Reiser and Molenda. One of its functions ADDIE guidance in building the training programs are effective, dynamic and performance support training for community empowerment craftsmen. This model was developed to create learning activities effectively and efficiently. Based on the pattern of the ADDIE operationally developed into the stages of research in the development of a model that becomes the direction and focus of the study.

Product Specifications Expected

Specification product generated in this study are;

1. Book learning model training (training model).
2. The manual work load trainer trainer working instructions used in the training process.
3. The guide book motif design and development, as well as processing techniques for students (learners), which contains the work instructions used by the learners (artisans) in the learning process.

Discussion

Crafts embroidery business development is one of the leading commodities in the domestic handicraft industry which supports the development of community economy, the industry is expected this craft can create added value relatively large able to absorb employment of women. At craft centers in the Pesisir Selatan implementation process of creating designs and motifs to craft product design using existing or motif. Design or motif was transferred kedasar the cloth would be embroidered with carbon paper. Displacement motif to the product to be made is done continuously, so it is not seen how the craftsmen were able to create designs and patterns according to the characteristics of the region, this has not been done by artisans.

Therefore embroidery as one of the heritage (cultural heritage high) which became an icon of the Indonesian nation and should continue to be preserved. The resulting product, both in terms of technical and motives must be maintained, in order to make crafts that they do demand by the consumer society. Workmanship is not just a finished product is made, but it should be working techniques by considering the aesthetics of the motifs used. To empower people in the marketing of craft techniques are required to market according to the tastes of consumers, in order to craft products sold in the market.

Crafts embroidery shadow and application is a work that has a functional and aesthetic value. For the functional value especially embroidery shadow, because the shadow embroidered with Arabic calligraphy menajdi have more aesthetic value in addition to its functional value. While work with aesthetic value are more likely to be used on clothing brackets, kebaya, baju koko children and koko men (Interview, Asnidar, March 2016). Forms of embroidery craft products developed among others mukena, clothes brackets, kebaya, baju koko, seat cushions.

Figure 1.
Shadow embroidery products for mukena calligraphy motif
Photo : Yuniarti Munaf, 2015

Figure 2.
Mukena with Shadow Embroidery Flora Motif
Photo : Yuniarti Munaf, 2015

Figure 3.
Mukena Embroidery Applications Calligraphy motif and Flora
Photo : Yuniarti Munaf, 2015

Figure 4.
Baju Kurung with Embroidery Motif applications Bungo Intan
Photo : Yuniarti Munaf, 2015

Products manufactured brackets shirt embroidered with various motifs applications adapted to the base material fabric of various colors.

Figure 5.
Baju Kebaya Embroidery Motif applications Bungo Lado
Photo: Yuniarti Munaf, 2015

Products kebaya embroidery motif bungo lado applications tailored to the kebaya with Marisa fabric base material. Kebaya dress is embroidered with hand embroidery and applications can be made with various motifs desired, tastes good craftsman and consumer tastes. The composition is balanced and symmetrical motifs that products manufactured kebaya more harmonious and beautiful.

Figure 6.
Baju Koko Laki-Laki dengan Motif Awan Bararak dan Rumah Gadang
Photo: Yuniarti Munaf, 2015

Figure 7.
Baju Laki-laki dengan Motif Kaluak Paku
Photo: Yuniarti Munaf, 2015

Koko men (men) are produced by artisans given motif in accordance with the balance and harmony of placement, at the front of the cloud motif by motif as bararak. Selection motif personalized leadership and artisans craft centers in accordance with the compatibility of the product to be embroidered. The color is also adapted to the basic fabric for koko to be embroidered with a pattern which is balanced and harmonized deployment. Color koko men are generally produced with colors such as dark and light gray, dark green, white, beige and so on.

Figure 8.
Motif Seat Cushion with Bunge Pitulo
Photo: Yuniarti Munaf, 2015

Seat cushions are manufactured in handicraft centers is the development of products other than clothing embroidered application in accordance with the basic color of fabric for the seat cushions. The motive for the seat cushions adapted to the balance and harmony of products and motifs used by craftsmen and owners taste centers. Placement motif refers to taste artisan based on market interest or buyers, are more often made kaluak nail motif. Seat cushions color is produced basic colors of black cloth embroidered with applications combined with various colors such as orange, purple, yellow, green and so on.

The forms Decorations

Ornamentation made for the decoration of an object there are many different forms, there is the shape of an animal, flower shape, the shape of natural objects and others. Various forms of decoration that can be grouped into four types, namely:

1. The natural form (naturalist), a form of decoration which is strongly influenced by the shape or the shape of natural objects and intangible nature of nature, which in penuangannya in the picture is very similar to the natural objects. For example, the shape of leaves, fruits, flowers, plants, animals, moon, sun, stars and others.
2. The form of decorative, tangible forms of nature are transformed into decorative shapes with stylized (composition / renggaan), supported by variety and arrangement of beautiful colors and harmoniously to form an attractive decoration.

3. The geometric shapes, the form design based on geometric elements such as rectangles, circles, triangles, cones, ovals, parallelograms, cylinders and others.
4. Form the abstract, is a form which contained the results of a free imagination that looks unusual or nothing in common objects of various objects both natural and man-made objects. Known also as the designs are shaped not real.

Used equipment for Embroidery Craft

Equipment used for processing embroideries as a traditional art form, the making of crafts embroidery products using very simple tools like a sewing needle with a medium size and a "ram" with a circle. This tool is used to straighten craftsmen sewn embroidery results. The usefulness of this ram to stretch the fabric to make it more presentable embroidered. Then a pair of scissors to cut the design to be embroidered applications and pencil to create a design motif that will be embroidered.

Figure 9
Cotton thread for embroidery
Applications and Shadow
Photo: Yuniarti Munaf, 2015

Figure 10
Needles, Ram, Scissors, Pencil
for Work Embroidery
Photo: Yuniarti Munaf, 2015

Embroidery Craft Making Process

The process of making crafts and needlework embroidery shadow application must first create a design for a motif to be embroidered on the product, such as the product mukena designed with calligraphy motifs, and there is also a floral motif (kaluak spikes). Kebaya and brackets designed clothes with floral motifs as well as the motive bungo lado, lumuik anyuik, kaluak nails, curtain Bungo, and leaves siriah. Male koko koko adults and children designed with the motive bungo pitulo, cloud bararak, longhouse, and fruit palo bapatah etc. Seat cushions are designed with motifs kaluak nails and the curtains Bungo.

The process of making the design done by craftsmen specifically to manufacture the design for the product. Craftsmen working on the product embroidery, needlepoint work that has been designed in accordance with the product motif embroidery. These artisans embroider with basic sewing techniques fabric that has been designed on the product type. This craftsman sewed with a very simple device with a sewing needle and cotton thread in accordance with the tastes of craftsmen and consumers. Preparation of the motives for embroidery customized products to be made based on the patterns of harmony and continuity.

The technique used to produce the shadow embroideries and applications are flat and skewer skewer straight. Flat skewers can be set to follow the desired pattern. Plugs straight (straight stitch) is also used for product application and shadow embroidery, with embroidery straight skewers that have been given motif can be stitched neatly and produces beautiful embroidery and interesting.

Placement of colors for customized embroidery products with design and color motif embroidery products, such as basic products orange combined with black for embroidery applications. Product embroidered with needlework meeting.

Figure 11
Craftsmen currently Working Embroidery Applications
Photo: Yuniarti Munaf, 2015

Conclusion

Embroidery craft art as a cultural heritage of the past presence begins to meet the needs of human life, then the craft was always developed in accordance with the current development of the times. Long history which has been recognized through embroidery as the nation's cultural heritage has a strategic position. As a mirror of people's lives embroidery has strategic value in the cultural system and the economic system of society.

The resulting embroidery can be made using simple equipment. Likewise, the production process is done by artisans still using traditional systems, but does not diminish the value of works of art produced in the life of society.

The use of embroidery as indigenous Minangkabau equipment still in use today. This is because the meanings contained in every ornament displayed on the embroideries, where in each of these ornaments are the values and teachings about the customs and life. Forms of decorative embroidery oriented forms that exist in nature, such forms of flora, fauna and of the nature of things can not be separated from natural philosophy takambang be a teacher.

The appearance of the natural forms that have been deformed at decorative fabrics weaving songket can not be separated from indigenous influences are so fused with the teachings of Islam, the only religion professed by the Minangkabau society, or better known as the philosophy of "customs basandi syarak syarak basandi Kitabullah ". Then depiction forms raised motif in the manufacture of decorative embroidery can not be separated from the cultural concepts of Islam which does not allow drawing living beings as a whole in each of ornamentation displayed.

The translation of the meanings symbolized by forms of decoration described by the adage-proverb, which generally contains about niali virtues and procedure of their lives according to the teachings of customs. Emblem disclosed as well as a reflection of the completeness and culture in the sense of value into a pattern of behavior Minangkabau society.

The emergence of new products are more varied, the function of art crafts embroidery which continue to be needed by the community, both as a practical goods as well as the completeness of ceremonies, then the existence of this craft will always be needed in the middle of the Minangkabau community and society.

Suggestion

The existence of embroidery craft art as a cultural heritage has grown, both in terms of quality and quantity. Nevertheless, in the form of preservation are still efforts to be made for the improvement and advancement of this embroidery craft business, so that the resulting products can seize a larger market and able to compete with other similar products.

There is still a lack of experience and knowledge in the management of art artisans of this craft, it is necessary to get more attention with respect to an increase in human resources in accordance with the progress today. The role of the government as official agencies, both local government and central government is expected to maintain the continuity of this embroidery craft art.

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